Extended Producer Responsibility in a Non-OECD Context: The management of waste electrical and electronic equipment in Thailand

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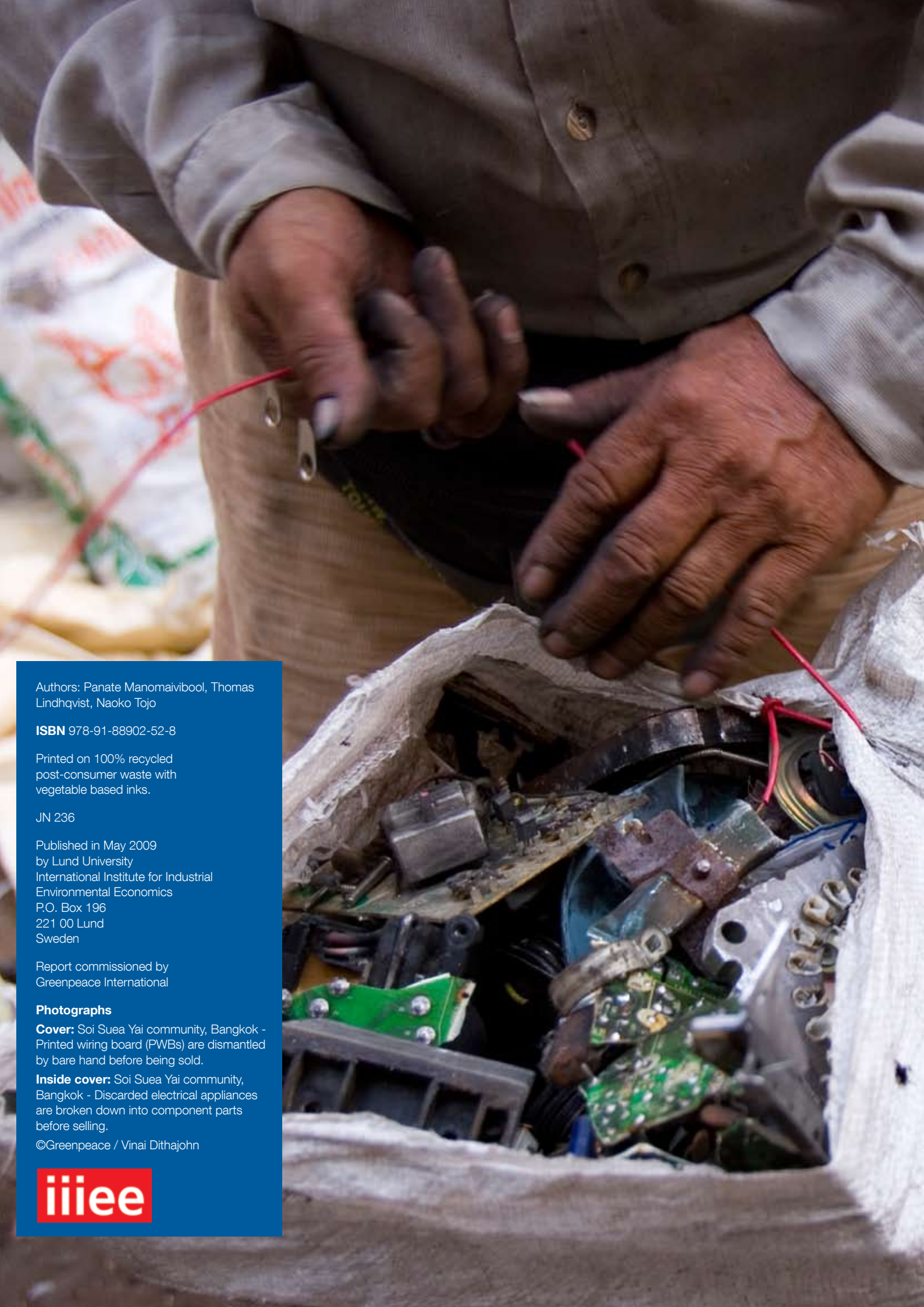

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Photographs

Cover: Soi Suea Yai community, Bangkok - Printed wiring board (PWBs) are dismantled by bare hand before being sold.

Inside cover: Soi Suea Yai community, Bangkok - Discarded electrical appliances are broken down into component parts before selling.

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Extended Producer Responsibility in a non-OECD context

The Management of Waste Electrical and Electronic Equipment in Thailand

Prologue by Greenpeace International

Greenpeace International commissioned this report to investigate how the principle of Extended Producer Responsibility (EPR) for Waste Electrical and Electronic Equipment (WEEE) could be applied effectively in countries outside of the Organization for Economic and Co-operation Development (OECD). This report focuses on Thailand, following reports focusing on India and Argentina.

Since 2000, Thailand has been developing a strategy to manage WEEE and is expected to enact a legal framework by 2011. This report provides in-depth analysis on the management of WEEE in Thailand. It acknowledges that, while there are existing challenges to introducing EPR legislation, there are also unique opportunities to craft Thai legislation as an example and encouragement for other non-OECD countries.

Like most non-OECD countries, Thailand is experiencing an accelerated growth in domestic e-waste generation with limited formal infrastructure to deal with it. Thailand also imports used electronics from developed countries for re-use and refurbishment, which quickly becomes e-waste. In the absence of producer responsibility and appropriate legislative framework and practices, most discarded electronic products either end up in places with no formal facilities for recycling, get recycled in very primitive conditions, are dumped with other types of wastes in landfill, or are incinerated. These practices cause significant impacts on the environment. Therefore, WEEE legislation that embraces elements of EPR should be an urgent task for the government.

To this end, we especially welcome one of the objectives of the Thai WEEE policy: 'to reduce hazardous wastes from EEE at the origin and to encourage environmentally friendly design and production'.

The challenges for WEEE legislation are not only to ensure high collection rates of e-waste to be channelled into safe recycling or proper disposal practices, but also to effectively address the root causes of these problems. These include lack of foresight in product design as to the use of hazardous substances in products that eventually lead to the release of harmful substances, with impacts on both workers' health and the environment, especially in situations where products are treated in informal treatment facilities (commonly know as backyard recycling).

Greenpeace believes that while waste management legislation creating the treatment capacity to minimise environmental impacts is important it is not enough. A generic WEEE legislation that requires companies to pay an undifferentiated fee into a government fund for treating the e-waste created by their products can provide funding for establishing the recycling infrastructure needed to deal with the e-waste using an end-of-pipe approach. However, it will not effectively provide incentives for producers to design more re-useable, recyclable and less toxic products. It will not deal with the problem of toxic e-waste at its source. In a true and effective IPR scheme, the cost of waste management is fully internalised right into the product price to make the producer financially responsible for his own e-waste. In turn, this promotes clean design and avoids the costs of detoxification being externalised to society and the environment.

Since it is the producers who have the power to choose what materials are to be used during the design of their products, only the producers can make the switch to safer materials. Making producers responsible for the costs related to the waste generated by their own products creates the incentive to design out the costs of dealing with toxic waste at the product design stage. These goals will only be achieved with a legislative framework that adheres to the principle of EPR and its refinement as Individual Producer Responsibility. More precisely, this means that the law must ensure that any product fees levied on new products to be used for end-of-life management - whether applied through a government fund or otherwise - are designed to reflect the reality of individual product design and the associated end-of-life cost consequences.

Using Thailand as a case study, this investigation acknowledges that although there are some unique challenges to introducing EPR legislation - such as the administrative coordination and the tendency towards a differing approach to national and multi- national companies - there are also opportunities, in particular the high-level of interest for using economic tools and some existing experience with take-back.

Overall, the report's authors conclude that there are no insurmountable obstacles to the implementation of EPR and IPR legislation in Thailand.

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GREENPEACE

Preface

This report, commissioned by Greenpeace International, presents research on the possibility of implementing the principle of Extended Producer Responsibility (EPR) for waste electrical and electronic equipment (WEEE) in non-OECD countries. The research conducted in 2008 focused on Thailand as a case study. The majority of the work – data collection and compilation of report – has been performed by Panate Manomaivibool.

The authors would like to thank Greenpeace International and Greenpeace Southeast Asia for engaging the IIIEE in the topical task of examining the possibility of applying EPR in non-OECD countries. The processes of reviewing experiences and arguments, interacting with stakeholders and observing the reality in Thailand have been both rewarding and challenging and enriched us with a deeper understanding of the principle and of non-OECD countries. Special thanks to Ply Pirom, Greenpeace Southeast Asia, who helped coordinate activities in Thailand.

The empirical materials regarding the WEEE management in Thailand constitute an integral part of this report. The authors would like to express our gratitude to the stakeholders for their time and invaluable inputs. Several reviewers have taken the time to read earlier draft versions of the report and their input is much appreciated and has improved the quality of the report significantly. We would especially like to thank external reviewers: Dr. Chirapat Popuang, Information and Technical Service Department, Electrical and Electronics Institute, Dr. Piyanee Thangtongtawi, the International Hazardous Waste Management Division, the Department of Industrial Works, and Dr. Sujitra Vassanadumrongdee, the National Center of Excellence for Environmental and Hazardous Waste Management, Chulalongkorn University, for their useful comments. The full responsibility for the report remains, however, with the authors.

Executive Summary

This report, commissioned by Greenpeace International, investigates the possibility of implementing the principle of Extended Producer Responsibility (EPR) for waste electrical and electronic equipment (WEEE) in one of the non-OECD countries – Thailand. Its aims are three-fold. Firstly, in Part 2, it clarifies the principle to facilitate its informed and complete implementation. Secondly, in Part 3, it checks the suitability of implementing EPR in the current Thai context. Finally, in Parts 4 and 5, the policy development in Thailand is reviewed and analysed.

Extended Producer Responsibility (EPR)

A policy principle with two families of objectives

EPR is a policy principle meaning that it aspires to certain goals and guides the selection and setting of policy instruments towards them. There are two families of EPR objectives. The first is design improvements of products and product systems. In other words, an effective EPR programme must systematically provide incentives to the manufacturers of targeted products to invest in design for environment (DfE). All things being equal, the closer an EPR programme comes to Individual Producer Responsibility (IPR) - where an individual producer bears the responsibilities related to the environmental performance of his/her products and product systems - the more effective it will be.

The second is high utilisation of product and material quality through effective collection, treatment, and re-use or recycling in an environmentally friendly and socially desirable manner. The end-of-life management has been the weakest link in the production responsibility chain and is an important stage where producers' responsibility is extended in existing EPR programmes. To be able to contribute to sustainable development, a downstream network under an EPR programme must not only be economically viable but also environmentally friendly and socially desirable. The presence of this environmentally and socially sound downstream system constitutes one of the three necessary components of an effective EPR programme together with functioning monitoring and reporting mechanisms, and resource flows from upstream to downstream systems.

Products are not homogeneous

Products under an EPR programme are not homogeneous, at least in the transitional period. A four-cell typology in Section 2.2 shows that different types of products have different emphasis in the programme. An effective EPR programme should: (1) differentiate between new and historical products; (2) prevent the occurrence of new, orphan products and free riders in general; (3) provide incentives for DfE in new product development; (4) ensure high utilisation of product and material quality through effective collection, treatment, and re-use or recycling of all products, and (5) have an acceptable method of distributing the costs relating to historical products. This is based on the fact that only new products can be redesigned and that the problem of new, orphan products – e.g. due to bankruptcy of an otherwise identifiable producer after he/she puts products on the market– can be prevented in an ex ante fashion with the front-end financial guarantees.

Different types of responsibility and several ways to implement IPR

There are four types of responsibility: physical responsibility, financial responsibility, liability, and informative responsibility. Some types of responsibility in certain activities can be advantageously allocated to other actors, besides the producers. Examples are: a retailer's physical obligation to provide a convenient take-back service to final consumers; municipalities' physical involvement in collection, and monitoring and enforcement by the trade association, competent authority, or third parties.

The analysis of types of responsibility also reveals that there is more than one way to implement IPR. IPR is possible even when the producers do not bear all types of responsibilities in all activities. Appendix I compiles such examples of IPR. Specifically, Sections 2.4 and 2.5 argue that IPR can exist within a Producer Responsibility Organisation (PRO) which is a crucial component of most, if not all, existing EPR programmes. Successful marriage between IPR mechanisms and a collective body is a prerequisite of the programme's effectiveness. Here, there will be incentives for design improvements, while the programme can still benefit from a PRO by helping small- and medium-sized producers to fulfil their responsibility; by lowering transaction costs and by peer monitoring of potential free riders.

EPR is implemented through a combination of policy instruments and should be sensitive to the local conditions of the context

EPR is implemented through a package of policy instruments – administrative, economic and informative instruments. Policy instruments are not inherently EPR and can also be employed in a non-EPR programme. However, when used in an EPR programme, their performance must be judged on how these policy instruments and their combination would contribute to the achievement of the two EPR objective families. Section 2.6 discusses the effects of such reinterpretation on four administrative instruments – substance restrictions, re-use and recycling targets, environmentally sound treatment standards, and treatment and disposal restrictions. It also illustrates the use of one informative instrument – labelling - together with a brief, general discussion of economic instruments.

To be effective, an EPR programme has to be sensitive to its context as well. Section 2.7 introduces an analytical framework where three

necessary mechanisms are nested in the context. The context is divided into three segments: product markets, consumption and WEEE generation, and WEEE processing. The framework is then applied to the analysis of the Thai context in Part 3.

Thai Context

Strong in production but weak in design

Thai E&E industries are, on one hand, very strong and a leading exporter of the country. The massive production also gives birth to the existing WEEE treatment and recycling industries, which can be incorporated in the future management system for post-consumer WEEE. On the other hand, product design and R&D remain a weakness of the industries. Many local manufacturers are only subcontractors and production houses. They might not yet be ready if an EPR programme would make this as an area of competitiveness. However, the deficit has been recognised as crucial to the prosperity of the industries in the global market and measures to strengthen the capacity have been implemented.

Consumption patterns can lend the WEEE system its manageability

The existing consumption patterns of EEE in Thailand can have positive implications for the management of WEEE. First, the level of consumption of urban households is significantly higher than that of their rural counterparts. This pattern corresponds well with the waste management infrastructure. The same is true for large business establishments, i.e. institutions with 50 or more employees are equipped with computers and together their ownership accounts for over 10% of the computer stock in the country. In addition, the markets of most equipment are well controlled and the problem of unaccountable shipments is relative minor. Exceptions are the cases of mobile phone batteries and computers. It is thus crucial to address the problem of counterfeit batteries. Regarding the latter, the future WEEE management system has to be able to accommodate the presence of assembled computers. This has been done in existing WEEE programmes abroad.

Extended product lifetime

A study shows that the lifetime of some products in Thailand is much longer than that in OECD countries. On one hand, the extended lifetime helps prolong WEEE generation. This extension owes much to repairing which is environmentally beneficial as long as there is a management plan for residues from the processes. On the other hand, it is also likely that this reflects the so-called hoarding effect or hibernation, which can be perceived as a collection problem.

In addition, the difference in product obsolescence creates demands for the imports of used equipment from industrialised countries to Thailand. Although this international reuse practice can be beneficial, it should be protected from any stealth attempts to import hazardous WEEE. Currently, relevant authorities have implemented several safeguard measures against such a malpractice. In the future, a sound recycling system should be established in Thailand. This will ensure that reused products will be handled with standards equal to those in their motherlands so there will be no trade-off between reuse and recycling.

Underdeveloped municipal solid waste management systems

In Thailand, municipal solid waste management is under the remit of local governments. However, most local governments do not have sufficient capacities to carry out this duty properly. The capacities also concentrate in urban areas. But even there, municipal services are in general limited to the collection and disposal of mixed wastes, though there have been sporadic attempts to promote source separation. An EPR programme by mobilising resources from producers can help enhancing source separation, separate collection, and proper treatment and disposal of specific waste streams.

Post-consumer WEEE remains on the periphery of recycling industries

Recycling is a lucrative business in Thailand. There are a lot of waste dealers dealing with waste collection and transaction, and material reprocessing factories in the country. However, post-consumer WEEE is handled on an ad hoc basis. The activities of existing authorised treatment facilities are at present limited to refurbishing or (preparation for) recycling of industrial wastes and residues. It is understand that a fraction of post-consumer WEEE might go through crude cannibalisation to retrieve its material contents in waste dealing chains. For its future management, collection and dismantling infrastructure and standard treatment procedures are much needed.

Law enforcement is in question

Despite no WEEE law at this moment, there are several pieces of legislation governing different parts of a product's life cycle. However, their effectiveness can be compromised by insufficient enforcement. Existing regulatory regimes rely much on command-and-control mechanisms. But problems and difficulties encountered in their enforcement have prompted Thai policy makers to consider economic instruments when they draft Thai WEEE laws. Nevertheless, the types of policy instruments do not change the importance of law enforcement. Inspection and monitoring and the maintenance of reliable databases should be integral parts of the future system.

Globalisation: good news and bad news

Thailand is active in trade globalisation and hence feels the effects of developments in other part of the world. On one hand, the development of product policies, like restrictions of hazardous

Executive Summary continued

substances in products, and WEEE programmes in OECD countries can have negative side effects in terms of inflows of inferior products and WEEE to unprotected non-OECD countries. On the other hand, Thailand can benefit from drawing on abundant international experiences when developing its own policies. In addition, we highlight the role of two types of actors that can facilitate the knowledge transfer (and adaptation) processes: developmental agencies and multinational corporations (MNCs).

Thai Policies and the Analysis

Policy development relating to the management of WEEE in Thailand took up around the beginning of the 2000s. It started as a response to the developments in the European Union (EU). Since then the attention has shifted to the management of WEEE in the country, resulting in several studies and policy documents. Three of them are the focus of Part 4.

Thai WEEE Strategy

The National Integrated Strategy for the Management of Waste Electrical and Electronic Equipment (the Thai WEEE Strategy) was a product of inter-ministerial work under the lead of the Ministry of Environment and Natural Resources and the Ministry of Industry. It established the objectives of Thai WEEE policies:

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

It also outlined future work and projects, responsibilities of different agencies, and timetables. In general, the roadmap envisions a gradual evolution starting with a pilot project before the system reaches its full maturity in 2017. According to the document, the legal framework was expected to be enacted midway, i.e. by the year 2011.

PCD's draft Act

The draft Act on the Promotion of the Management of Hazardous Waste from Used Products (the PCD's draft Act) was the first draft law that went to the public in 2004. It was produced by the Pollution Control Department (PCD) based on a study it commissioned. In a nutshell, it proposed a governmental fund model where product fees were levied on new products to be used in the end-of-life management. Unlike most EPR programmes, administration and physical responsibilities would belong to national and local governments.

FPO's draft Act

The draft Act on Economic Instrument for Environmental Management (the FPO's draft Act) was an attempt by the Ministry of Finance to unify attempts to introduce economic instruments for environmental purposes. One such attempt was the FPO's draft Act. Under this proposed institutional arrangement, the PCD's draft Act would be modified into a draft Royal Decree under the FPO's draft Act. Although it is understood that the governmental fund model remained at its core, there were issues that PCD and the Fiscal Policy Office (FPO) have to find an agreement on, particularly the management of the money. In addition, besides the financial mechanisms, most of the programme details were not specified in the draft acts.

Policy Analysis

Administrative fragmentation and coordination

Part 5 offers an analysis of the policies and policy processes from an EPR perspective. The policy development in Thailand reflects very well our thesis of administrative fragmentation and life cycle thinking. Under existing institutions, there are a number of authorities regulating the production, consumption and end-of-life management of EEE. This condition presents both opportunities and challenges to EPR, trying to link the different life cycle phases. On one hand, it allows upstream (production & consumption) policies, such as RoHS, to be developed independently with a more comprehensive scope under existing product standard laws while leaving more time for the new WEEE management framework to gradually evolve. On the other hand, the fragmentation can result in turf wars between agencies with overlapping jurisdictions. In any case, coordination is the key to ensure that independent and/or competing initiatives will not be counterproductive but can instead bring about synergistic results.

Producers are not the same

The fragmentation is not limited to the government but also exists among producers. Producers are quite a diverse group of actors including original equipment manufacturers (OEM), brand owners, and third-party importers. It appears that Thai WEEE follows the (factory-and-custom) gate approach (as opposed to a brand approach) when legally defining the producers and their responsibilities, which are mainly financial and informative. Consequently, the consultation thus far between the government and the industries has been limited to local manufacturers.

However, our research finds that local manufacturers (and possibly independent importers), on one hand, and MNC brand owners, on

the other hand, might have very different set of preferences towards their responsibilities at the end-of-life of the products. The latter backed up with their international experiences and global policies are more ready to take up the challenges that can affect their brands. The difference also exists between product groups. MNCs in the ICT sector, some of which voluntarily offer take-back services for their products in Thailand, stand out from the rest. They are very critical to the government fund model and support the idea of more producers' responsibilities and control through some sorts of opt-out options from the government-run programme.

Appreciate the difference with a selective co-evolution

We suggest that these diverging views can be seen positively, taking into account the determination of policy makers to have a governmental programme with a selective scope. In this policy context, the existence of voluntary take-back schemes for the majority of the products in the market can be a criterion to exclude certain product groups from the first programme's scope. The co-existence of the governmental programme and voluntary schemes allows us to review the performance, e.g. in terms of recovery rates, of each in the light of the other. Then, the scope should be reviewed periodically to include more product groups with ineffective voluntary schemes to or exclude certain groups or particular producers that are more effective and efficient on their own from the central system.

Institutional users: a candidate for the pilot project

We also identify institutional users as a strategic starting point of the gradualism proposed in the Thai WEEE Strategy. Some institutional users can be targeted for additional waste disposal requirements and obligations. Criteria independent from the number of EEE/ WEEE, e.g. the number of employees in the establishments in the case of computers, can be employed for the targeting. It can also imagine that such a measure on these bulk consumers can lead to procurement policies that favour the producers who offer asset management programmes for obsolete items and, hence, encourages producers' interest in the end-of-life management.

In conclusion

EPR has the potential not only to ensure the management of WEEE in an environmentally sound manner, but also to address the root cause of the problem, i.e. the design of products and product systems. In principle, a programme should be designed to encourage the involvement of producers in the end-of-life phase of products' life cycle, through the (re-)allocation of product responsibilities. We argue that such a strategy is very much possible under the situational and policy context of Thailand, although a lot of work has yet to be done. We also encourage more dialogues between key stakeholders in the journey ahead.

List of Acronyms

ADB	Asian Development Bank
ATF	Authorised treatment facility
B2B	Business-to-business
B2C	Business-to-consumer
BOI	Board of Investment, Thailand
CFCs	Chlorofluorocarbons
CPR	Collective producer responsibility
CRT	Cathode ray tube
CSR	Corporate social responsibility
DfD	Design for disassembly
DfE	Design for environment/Eco-design
DfR	Design for recycling
DIW	Department of Industrial Works, Thailand
DVD	Digital versatile disc
E&E	Electrical & electronic
EEE	Electrical and electronic equipment
EEI	Electrical and Electronics Institute, Thailand
ELV	End-of-life vehicle
EMS	Environmental management system
EoI	End-of-life
EPR	Extended producer responsibility
EU	European Union
FPO	Fiscal Policy Office, Thailand
FTI	Federation of Thai Industries
GAP	Green Aid Plan
HDD	Hard disk drives
ICT	Information and communication technologies
IPR	Individual producer responsibility
LG	Local government
METI	Ministry of Economy, Trade and Industry, Japan
MNC	Multinational corporation
MoF	Ministry of Finance, Thailand
MoI	Ministry of Industry, Thailand
MoNRE	Ministry of Natural Resources and Environment, Thailand
MSW	Municipal solid waste
MTEC	National Metal and Materials Technology Center, Thailand
NECTEC	National Electronics and Computer Technology Center, Thailand
NGO	Non-governmental organisation
NIMBY	Not in my backyard
NSO	National Statistical Office, Thailand
OECD	Organisation for Economic Co-operation and Development
OIE	Office of Industrial Economics, Thailand
PAHs	Polycyclic aromatic hydrocarbons
PBDEs	Polybrominated diphenyl ethers
PCD	Pollution Control Department, Thailand
PRO	Producer responsibility organisation
PSS	Product-service system
PVC	Polyvinyl chloride
PWB	Print-wired board
R&D	Research and development
RFID	Radio-frequency identification
RoHS	Restriction of the use of certain hazardous substances
SHARL	Specific Home Appliance Recycling Law
SKF	Suankaew Foundation, Thailand
SMEs	Small- and medium-sized enterprises
SRI	Social Research Institute, Chiang Mai University, Thailand
TCC	Thai Chamber of Commerce
TEI	Thailand Environment Institute, Thailand
TISI	Thai Industrial Standards Institute, Thailand
VOCs	Volatile organic compounds
WEEE	Waste electrical and electronic equipment/ E-waste

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image Soi Suea Yai community, Bangkok - Printed wiring boards (PWBs) are dismantled by bare hand before being sold

Part 1
Introduction

Waste electrical and electronic equipment (WEEE, also known as e-waste) is a growing concern of Thai society and policy makers. The penetration rate and variety of appliances have been increasing in the last few years hinting at the magnitude and the complexity of the future waste stream. While WEEE can contain valuable materials which drive its recycling, international experiences show that without sufficient safeguards the green mantra of recycling can turn to be a health and environmental nightmare (see Box 1). Currently, Thailand does not have a proper system to handle waste from these high-tech products and risks to expose itself to these grave health and environmental hazards. Yet, there has been a concerted effort to forge WEEE policies in Thailand.

Thailand is not the only country facing the WEEE problem. Many OECD countries began encountering this problem earlier. To various degrees, these countries embraced the principle of Extended Producer Responsibility (EPR) at the core of their strategy to redress the situation. At present, a few non-OECD countries including Thailand are in the process of examining the prospect of applying this principle to their national situation.

Against this background, this report aims to contribute to WEEE policy making in Thailand, especially in relations to the principle of EPR. The research began in early 2008 with an extensive literature review, particularly on WEEE policy development in Thailand. Primary data were collected during a visit to Thailand by the first author between 1 April and 8 May 2008, through direct observation and interviews with key informants. In total, there were 26 face-to-face and telephoned interviews. It was supplemented by the participation in a workshop on the management of hazardous wastes and chemicals organised by the Thai Research Fund on April 2, 2008. The list of all interviews can be found in the reference, except for five occasions when companies requested not to disclose such information.

This work is a continuation of our previous works in which we explored the possibility of applying the concept of EPR for WEEE management in India (Manomaivibool et al. 2007) and in Argentina (Lindhqvist et al. 2008). After EPR is introduced in Part 2, in addition to identifying opportunities for and challenges to its implementation, Part 3 ventures to analyse patterns that underline these conditions in the Thai context. Unlike the Indian and Argentinean projects that were carried out when the WEEE policy making was in its early stage, key policy documents and draft laws do exist in Thailand. This enabled us to analyse the policy content and processes, as found in Part 4 and 5. Part 6 concludes the findings of the study.

Introduction

Box 1 Backyard recycling: its hazards and inefficiency

Post-consumer WEEE recycling in many non-OECD countries is, by and large, handled in so-called 'backyard recycling'. Informal recyclers are after precious metals such as gold, silver and copper in WEEE. They apply rudimentary methods and tools to separate these metals from complex components and subassemblies of WEEE. Among the most risky operations are: heating to de-solder circuit boards over an open flame; treatment of printed wiring boards (PWBs) in acid baths to recover gold and other valuable metals; open burning of PVC-coated wires and cables to recover copper; destructive methods to separate materials in cathode ray tubes (CRTs), and open burning of residues to recover metals. In addition, waste from the operations is directly dumped on nearby soils and in water bodies.

Several studies have documented pollution related to backyard recycling. The most infamous case is the town of Guiyu, Guangdong, China. A series of investigations in Guiyu between 2003 and 2005 shows: (1) elevated concentrations of polybrominated diphenyl ethers (PBDEs) in soil and sediment samples, with substance profiles similar to various technical formulations of flame retardant products (Wang et al. 2005); (2) contamination of soils with carcinogenic, mutagenic, teratogenic and bioaccumulating polycyclic aromatic hydrocarbons (PAHs), especially soils from sites used for the open burning of wastes (Yu et al. 2006); (3) high concentrations of heavy metals such as cadmium, copper, lead and zinc in sediment samples from the Lianjiang river, consistently above the Interim Sediment Quality Guidelines set for Canadian standards (Wong et al. 2007),and (4) concentrations of some heavy metals associated with fine particulates (PM2.5) in air samples ranging from 4 to 33 times higher than those recorded in other Asian cities (Deng et al. 2006). These findings convey a similar picture of environmental contamination around electronic waste recycling facilities to that reported in the study of such facilities in both China and India conducted by Brigden et al. (2005). More recently, an experiment simulating open burning of PWBs and PVC-coated wires reported high concentrations of heavy metals, dioxins and furans (both chlorinated and brominated) in fly ash and high leaching capacity of metals from the residual ash (Gullet et al. 2007).

Adverse consequences at damage levels are also evident. Bi et al. (2007) find the average concentration of BDE-209 in Guiyu workers to be 50-200 times higher than the results previously reported in humans. One study finds high blood lead and cadmium levels in among samples of Guiyu children comparing to those from a reference town (Zheng et al. 2008).

The working conditions in the sector are detrimental, with very limited, if any, protection for health and safety of workers and surrounding communities. Neither does the backyard recycling fare well in terms of resource conservation. A recent study (cited in Rochat 2007) estimates the overall efficiency of a wet chemical process to recover gold from PWBs in India at a maximum of 20%. This compares to 95% in a state-of-the-art facility in the EU that can recover not only gold but also 16 other precious metals with lower total emissions.

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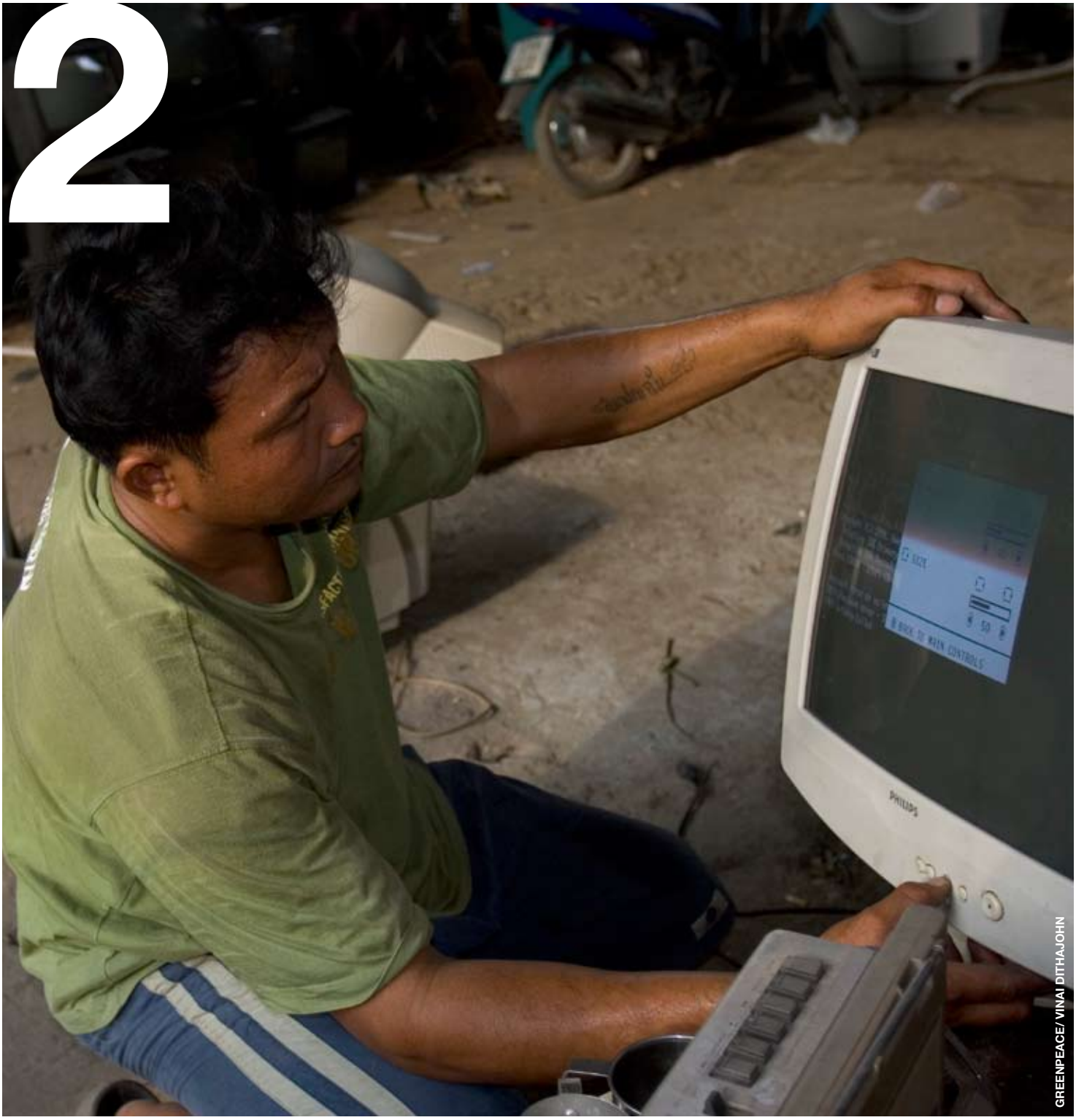


image Soi Suea Yai community, Bangkok - Discarded electrical appliances, TV monitors and computers are being stacked to await dismantling

Part 2
Extended Producer Responsibility

The term 'Extended Producer Responsibility' (förlängt producentansvar) was first introduced officially in a report to the Swedish Ministry of the Environment, Models for Extended Producer Responsibility (Lindhqvist, and Lidgren 1990). Subsequently, the concept was revised and defined as an environmental principle:

> "a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product. A policy principle is the basis for selecting the mix of policy instruments that are to be used in the particular case. Extended Producer Responsibility (EPR) is implemented through administrative, economic and informative policy instruments" (Lindhqvist 2000, 154).

This definition reflects three cornerstones of EPR, namely the 'pollution prevention approach', 'life cycle thinking' and 'polluter pays' principles. To date, EPR has been applied in many OECD many countries and has focused mainly on the end-of-life stage, "the 'weakest link' in the production responsibility chain" (Kroepelien 2000, 166), of several product and packaging wastes.

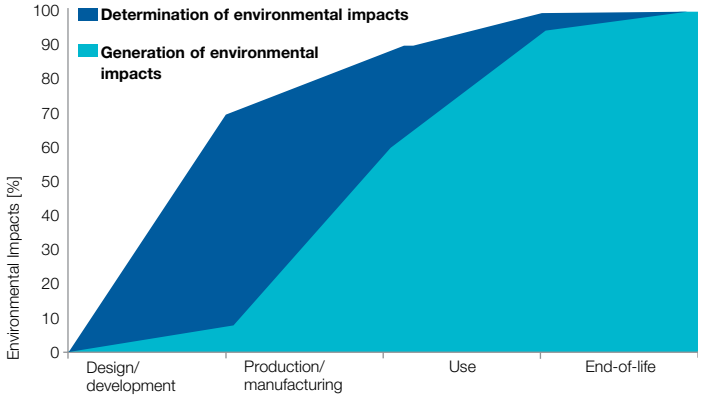
Some authors treat EPR as merely shorthand for either a take-back mandate or a kind of economic instrument (Gottberg et al. 2006; Sachs 2006). In this paper, however, following the definition mentioned above, EPR is treated as a policy principle and policy makers are free to choose any policy instruments, or their mix, to accommodate particular contexts and to implement the spirit of EPR.

2.1 Objectives: why producers?

There are two families of objectives in an EPR programme: (1) design improvements of products and their systems, and (2) high utilisation of product and material quality through effective collection, treatment, and re-use or recycling [in an environmentally friendly and socially desirable manner] (van Rossem, and Lindhqvist 2005). The phrase added at the end of the second family of EPR objectives plays a crucial role when the principle is discussed in the context of non-OECD countries where, before the establishment of any EPR programme, downstream activities might be handled by groups of disadvantaged populations such as rural-urban immigrants in the so-called 'informal' sector.

The first family is a distinctive feature of the principle. Looking through the lens of life cycle thinking, EPR redefines products and their design as a vessel and a root cause of environmental problems, respectively (Heiskanen 2002; Lindhqvist 2000). The very reason that responsibilities are placed on manufacturers is because most of the environmental impacts are (pre-)determined when products are designed, as graphically shown in Figure 1. Following the pollution prevention approach, an effective EPR programme provides incentives for manufacturers to embrace Design for Environment (DfE) – "the development of products by applying environmental criteria aimed at the reduction of the environmental impacts along the stages of the product life cycle" (Bakker 1995). It must be stressed that this first family of EPR objectives is fully applicable only to new products not yet on the market, which can be re-designed (van Rossem et al. 2006a).

Figure 1 Generalised representation of the (pre)determination and the generation of environmental impacts of a product's life cycle



Source: (Rebitzer 2002, 702)
Note: this only shows a broad impression of the issue. The actual division of impacts along life cycle phases does vary across products, e.g. that of a refrigerator will be heavy during the use phase, while that for an x-ray machine will be dominated by the impacts in the production.

There are at least two factors influencing the strength of the design incentive: excludability and immediacy. A manufacturer is likely to invest in DfE if he/she is able to exclude competitors from enjoying the benefits of the investment. All other things being equal, the closer an EPR programme comes to Individual Producer Responsibility (IPR) –- where an individual producer bears responsibilities for his/her own products –- the more effective it will be (see Section 2.4). Concerning immediacy, the more immediate the benefit, the stronger the incentive for DfE. This is especially relevant in dynamic markets, such as that of EEE, where the life span of a product might be longer than that of its manufacturer.

Design improvements can be further divided into two categories, product design improvements and product system design improvements. Examples of product design improvements are the

selection of low-impact materials or substitution of components; the reduction of the product's size and weight; Design for Disassembly; Design for Recycling, and the increase in a product's life span through upgrading, etc. On the other hand, a product system is concerned with all other factors, besides the product per se, that enable the functionality throughout the life cycle (Lindhqvist 2000). Examples of product system improvements include development in recycling technologies, reverse logistics, and marketing strategies, such as product leasing.[1]

Concerning the second family of EPR objectives, an effective EPR programme must first be able to separate discarded products and incorporate them into the system (collection). Second, the collected WEEE must be treated in an environmentally sound manner. Third, its material and calorific values should be optimally extracted through re-use, material recycling, and energy recovery, i.e. in accordance with the so-called 'waste hierarchy'. This family of objectives is equally applicable to both new products and historical products, i.e. products put on the market before the introduction of an EPR programme (see Section 2.2).

Although these objectives could be achieved through non-EPR approaches, there are at least three advantages in placing responsibilities on a producer. Firstly, placing clear responsibilities on one actor would avoid the situation where everyone's responsibility becomes no one's responsibility (Lindhqvist, and Lifset 1997). Secondly, if a producer knows that he is responsible for managing his products at the end of their life, he would have an incentive to incorporate the end-of-life considerations in his design. This points towards IPR (see Section 2.4). Finally, assigning responsibilities to a producer, even for historical products, would eventually lead him/her either to physically involve him/herself in end-of-life management or enter into a dialogue with downstream actors. This would provide a producer with learning opportunities regarding design for end-of-life (van Rossem et al. 2006a). Good examples can be seen from the management of end-of-life vehicles and WEEE in Europe and Japan (see Manomaivibool 2008b; Tojo 2004; Hartman et al. 2000).

2.2 Types of Products

Products that fall under an EPR programme can be classified into four groups. Table 1 shows the four groups on the basis of two criteria: the ability to identify its producer and the time when the product is put on the market. The identification of the producer matters whenever his/her responsibility is required in respective

Table 1 Types of products

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

EPR programmes.[2] The second criterion means an effective date is specified in an EPR programme that enables a distinction to be made between new and historical products.

This typology captures other common terms. New products are those in groups A and B. Historical products are those in groups C and D. Orphan products — the products whose responsible producer cannot be identified and hence a free rider — are those in groups B and D. Moreover, the typology helps in clarifying the relation of each group of products to the EPR objectives.

Products in group A are the prime and most straightforward targets of an EPR programme, because their producer is identifiable - thus possible to be held responsible for downstream activities – and they have not yet been put on the market – thus opportunities for design change exist. In other words, both families of EPR objectives apply to this group with a priority on incentive for DfE.

Products in group B are also the targets of an EPR programme but rather problematic ones. Though they are new products, and it is possible to aim at both objective families, the fact that their responsible party would not be identifiable renders this irrelevant. Hence, the first priority regarding this group of products is to reduce or, if possible, eliminate them; i.e. ideally all new products should be in group A. This can be done by, for instance, requiring a financial guarantee from the producer when a product is put on the market as in the so-called WEEE Directive in Europe.[3] In the countries where there is a systematic channel selling so-called 'no-name-branded products' (these products can be called 'born-to-be orphan') this problem would be more complicated (see Section 3.2).

Products in groups C and D — historical products — are an unavoidable extra of any EPR programme for durable products. The potential of design improvements is limited for these groups of

1 Broadly speaking, the second family of EPR objectives can be perceived as part of product system improvements. Nevertheless, because of the end-of-life-orientation of EPR programmes, the actual downstream improvements will be treated as a separate family.

2 For example, regarding financial responsibility, the time of identification is at the point-of-sale in a programme with a front-end mechanism, while it is at the end of the product's life in a rear-end programme.

3 Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on the waste electrical and electronic equipment (WEEE). OJ L37 13/02/2003 p.24 –39

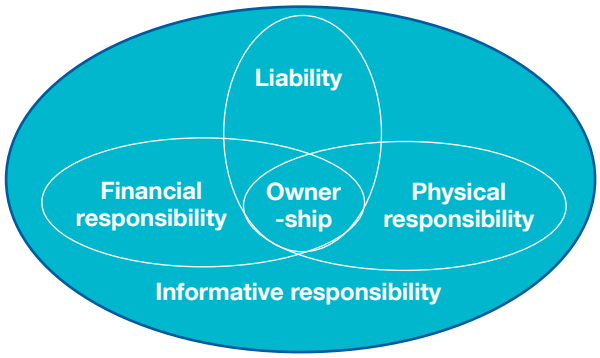
products. Moreover, the proportion of historical, orphan products (group D) could be considerable. The problem of historical, orphan products (group D) cannot be resolved in advance, as the products had already been placed on the markets and their producers had subsequently disappeared before the establishment of any financial mechanisms. Important issues are then how to organise a cost-effective downstream system and to find a fair way of distributing the handling costs of historical products (if any) among existing actors.

In summary, an effective EPR programme must: (1) differentiate between new and historical products; (2) prevent the occurrence of new, orphan products and free-riders in general; (3) provide incentives for DfE in new product development; (4) ensure high utilisation of product and material quality through effective collection, treatment, and re-use or recycling of all products, and 5) have an acceptable method of distributing the costs relating to historical products.

2.3 Types of Responsibility

The extension of responsibilities to manufacturers varies between EPR programmes, both in terms of types of responsibility, as well as activities to be undertaken. Figure 2 provides a classical typology of responsibilities, introduced by Lindhqvist in 1992.

Figure 2 Model for Extended Producer Responsibility



Source: (Lindhqvist 1992)

Definitions of these four types of responsibility are given below: (Lindhqvist 2000 38-9):

> **"Liability** refers to a responsibility for proven environmental damages caused by the product in question. 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.
>
> **Economic [Financial] responsibility** means that the producer will cover all or part of the costs for e.g. the collection, recycling or final disposal of the products he is manufacturing. These costs could be paid for directly by the producer or by a special fee.
>
> **Physical responsibility** is used to characterise the systems where the manufacturer is involved in the actual physical management of the products or of the effects of the products. …
>
> **Informative responsibility** signifies several different possibilities to extend responsibility for the products by requiring the producers to supply information on the environmental properties of the products he is manufacturing [e.g. to recyclers]."

Retaining ownership of his/her products throughout their life cycle, as in a product-service system (PSS), is the ultimate means for a producer to fulfil his/her full responsibilities.

Retaining ownership of his/her products throughout their life cycle, as in a product-service system (PSS), is the ultimate means for a producer to fulfil his/her full responsibilities.

Table 2 further identifies elements of responsibilities as far as the end-of-life management is concerned. In principle, the more responsibility a producer assumes, the stronger the EPR mechanisms. In designing a programme, however, it might not be necessary for a producer to be responsible for every aspect or be involved in every activity in order to achieve the aforementioned objectives. For example, in many programmes, retailers, due to their widespread networks and convenience for consumers, are obliged to take obsolete products from consumers (Element 1) on various bases — e.g. on a one-to-one basis, on a basis of types of products sold – - and to provide information to make customers aware of the service (Element 3); in certain cases, they bear the collection costs (Element 2) as well. Monitoring and enforcement (Element 7) is another activity where separation of responsibility can be desirable. In most cases, collective bodies such as Producer Responsibility Organisations (PROs) and industry associations play a leading role in this element (see Section 2.5). Where the issue of credibility is decisive, as in Taiwan in 1997, a third party independent from the industry might be introduced to perform such a role (Lee et al. 1998).

Table 2 Types of responsibility by downstream activities

Type of responsibility	Activities	Collection	Recovery	Monitoring & Enforcement
	Physical management	Element 1	Element 4	Element 7
	Financial mechanism	Element 2	Element 5	
	Information management	Element 3	Element 6	

Source: (Tojo 2004, 176)

2.4 Individual Producer Responsibility (IPR)

Individual producer responsibility (IPR) exists where an individual producer is responsible for proper management of his/her own products. Tojo (2004 274-6) lays down the following definitions:

> "… a producer bears an individual financial responsibility when he/she initially pays for the end-of-life management of his/her own products. When a group of producers pay for the end-of-life management of their products regardless of brands, their financial responsibility is collective.
>
> … a producer bears an individual physical responsibility when 1) the distinction of the products are made at minimum by brand and 2) the producer has the control over the fate of their discarded products with some degree of involvement in the organisation of the downstream operation ...
>
> … producers have individual informative responsibility with regard to the collection and provision of information concerning their products and product systems, such as the location of hazardous substances, types of materials used, the routes through which the components and materials reach their production sites and the like. …."

IPR is desirable, at least for new products, because the responsibility of each producer would relate to the characteristics of their products and product systems. Where EPR is introduced in a way that all producers are equally affected –- irrespective of the design of their products, and producers can shift most of the costs to the consumers –- the financial incentives for design improvement, if any, would be minimal (see Gottberg et al. 2006). In an IPR system, a rational producer would try to optimise their products and product systems to maximise their profit. However, it is perceived that implementing IPR is difficult, if not impossible, owing to practical considerations such as duplicated systems and high transaction costs, uncertainty in the end-of-life costs for complex products, and a need for a supplemental system to address the problems of orphan products and historical products, etc. (cited in Tojo 2004). Nevertheless, this criticism is based on a false assumption that there is only one form of IPR where each producer bears all types of responsibilities, i.e. "individual producer" would appear in Elements 1-6 in Table 2. In reality, different forms of IPR exist, where single producer bears a responsibility for certain (but not all) elements individually, examples of which are found in Appendix I.

2.5 Producer Responsibility Organisation (PRO)

Producer Responsibility Organisation (PRO) is usually a not-for-profit organisation established by a group of producers to exercise/facilitate the implementation of their designated responsibility. Though they work in a fairly similar manner, PROs are qualitatively different from governmental funds in that producers still retain some control over PROs.

There are several reasons that many existing – but not all – EPR programmes establish (a) PRO(s). Firstly, some producers such as small players or importers might not have enough capacity or would be put at a disadvantage, e.g. in negotiating a contract with recyclers and carrying out their own responsibility through their own individual systems. Secondly, there is an economy of scale in some activities such as collection. Thirdly, a PRO can facilitate monitoring and enforcement and lower the transaction costs in the system. For example, BPS, a PRO for Swedish car producers, certified a number of dismantlers with whom its members chose to make a contract to exercise the physical responsibility on their behalf. In addition, a PRO might facilitate the alleviation of free riders as a way of protecting the interest of its members (i.e. identifiable producers).

These reasons by no means warrant the monopoly of any PRO. A monopoly by a PRO, despite its economy of scale, might lead to unnecessary high prices of services due to a lack of competition to keep down the prices.

The mere existence of a PRO, even a monopolistic one, does not necessitates a full degree of collective producer responsibility, i.e. "producers collectively" appears in Elements 1-6 in Table 2. For example, a monopolistic PRO can employ differentiated fees, to incentivise design improvements, as is the case for the German packaging programme. Alternatively, a fee and refund at flat rates could be used while a producer is entitled to get the refund from the PRO for the amount he/she has managed individually.

Regardless of the arrangement, an effective EPR programme must create a competitive atmosphere where each producer is

encouraged to translate environmental performance into business competitiveness. This is a challenging but possible task.

2.6 Policy Instruments

EPR is a policy principle which can be translated into a repertoire of policy instruments. Instruments used in respective EPR programmes should be adapted to the products and local contexts. Table 3 gives an inexhaustible list of policy instruments found in EPR programmes. Five of them (bold in Table 3) are discussed in details below. These instruments are not inherently EPR-oriented and can be used in non-EPR programmes as well. Here, their use and potential are reinterpreted under an EPR paradigm, i.e. how these policy instruments and their combination would contribute to the achievement of the two EPR objective families.[4]

Table 3 Examples of EPR-based policy instruments

Administrative instruments	Collection and/or take-back of discarded products, **substance restrictions***, achievement of collection, **re-use (refill) and recycling targets,** utilisation mandates**, **environmentally sound treatment standards, treatment and disposal restrictions***, minimum recycled material content standards, product standard
Economic instruments	Material/product taxes, subsidies, advance disposal fee systems, deposit-refund systems, upstream combined tax/subsidies, tradable recycling credits
Informative instruments	Reporting to authorities, **marking/labelling of products and components,** consultation with local governments about the collection network, information provision to consumers about producer responsibility/source separation, information provision to recyclers about the structure and substances used in products

* Some exclude substance and landfill bans from EPR-based policy instruments.
** Utilisation mandates refer to the situation where producers should achieve certain re-use and /or recycling targets, but do not have to use them within their own activities.
Source: Tojo (2004, 14) with some instruments highlighted in bold in this report.

Substance restrictions are an administrative instrument. From a design perspective, they force manufacturers to remove toxics from their design. From the downstream perspective, they ensure less-hazardous inputs and hence safer treatment and recovery processes. Prominent examples of this instrument are the so-called RoHS Directive in the EU restricting the use of six substances[5], and the phase-out of CFCs in cooling appliances according to the Montreal Protocol. Previous studies all agree on the effectiveness of the Directive in stimulating (re)design of EEE even outside the EU (Gottberg et al. 2006; Røine and Lee 2006; Sachs 2006; Yu et al. 2006; Tojo 2001). Similarly, Laner and Rechberger (2007) find the use of VOCs as a refrigerant and as a blowing agent instead of CFCs has significantly reduced the environmental impacts of material recycling of cooling appliances.

Re-use and recycling targets are a kind of administrative instrument prescribing the minimum level of re-use and recycling of collected WEEE. Ideally, Bohr (2007) suggests that there should be differentiation between different grades and applications of outputs from different recycling processes, e.g. between closed-loop (re)utilisation and downcycling. However, most of the existing targets are weight-based and make no distinction between closed-loop and downcycling, except in Japan where only recycled materials with positive values can be counted toward the targets. Though the targets mainly focus on the second objective family, from an EPR perspective, their effectiveness should also be judged from the signal they give to the designers, e.g. in the selection of materials.

In the systems with an authorisation procedure there are **environmentally sound treatment standards** that WEEE-related enterprises need to comply with. The standards can be either emission standards or production/specification standards (Faure and Skogh 2003). The latter can take the form of prescribing specific treatments for certain components and/or materials and/or technical requirements of the storage and treatment sites. Examples are Annexes II and III of the EU WEEE Directive, respectively (reproduced in Appendix II). Regardless of the types of standards, their effectiveness is heavily dependent on the ability of respective authorities to monitor and enforce them. One way to ease monitoring and enforcement is to encourage treatment plants to have an environmental management system (EMS).

Contrary to treatment standards (instructing what to do) are **treatment and disposal restrictions** (instructing what not to do) such as those against landfill of waste containing hazardous substances, burning of PVC, etc. These instruments control, if not prohibit, any operations deemed to pose high risks to public health and the environment. The restrictions might also lead equipment and material producers to develop alternative and safer treatment

4 The discussion of economic instruments is intentionally avoided because there exists a sizable body of knowledge about the issue (see Bohr 2006; Calcott, and Walls 2005; Eichner, and Runkel 2005; Krozer, and Doelman 2003; Fullerton, and Wu 1998).
5 Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. OJ L 37 13/02/2003 p.19 –23. The restricted substances are lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE)

and disposal methods for their products and materials. In an age of globalisation, for these national restrictions and standards to be meaningful, a framework to control transboundary movement of WEEE is necessary. In this sense, the existing global platform of the Basel Convention[6] contributes to a national EPR programme in two major ways. Firstly, in the country where WEEE is generated, it prevents producers from opting for cheap and easy (but undesirable) solutions to get rid of their responsibility. Secondly, in the prospective recipient country, it safeguards the programme against illegal inflows of foreign WEEE.

Generally, administrative instruments is perceived to lack built-in dynamics and do not encourage actors to go beyond the requirements. However, it can be over come by measures such as progressive targets over time and periodic review and adaptation to scientific and technical progress.

Labelling plays a crucial enabling role in an EPR programme. Firstly, it can indicate the marketing time of products which is instrumental for the distinction between new and historical products. Secondly, a label can be used to inform the users about their role in separate collection of WEEE. Thirdly, to further facilitate IPR, the responsible producer of new products should be identifiable. Beyond these enabling roles, this informative instrument can also stimulate design improvements and high utilisation of product and material quality (Schischke et al. 2005). For example, the J-MOSS Standard in Japan (JIS C 0950:2005), instead of outright banning the use of six substances as in the RoHS Directive in Europe, requires producers to label the contents on the equipment casing, containers and catalogues, when the presence of these substances exceeds specified limits. Substance and sorting marking can also facilitate downstream activities (Shimamura et al. 2005). The end-of-life management can be further facilitated if the producers are obliged to provide re-use and treatment information to re-use centres and treatment and recycling facilities, i.e. the information provision instrument.

2.7 Contexts and necessary components

Figure 3 outlines a simplified scheme of a context that normally nests an EPR programme. The context is divided into three segments. The first segment is the market place for products, in this case, EEE. Two types of distribution channels for new products are illustrated: accountable and unaccountable. The latter delivers products, whose producer is not identifiable, i.e. born-to-be orphan products (group B in Table 2). Second-hand products are sold in the re-use market and are dependent partly on the downstream operation for spare parts retrieved from WEEE.

The second segment is consumption and post-consumer waste generation. Domestic users play double roles both as a consumer of EEE and as a generator of WEEE. Some discarded but functional products will re-enter via the re-use market. Two types of consumers are depicted in Figure 3: institutional users and private households, because the nature of WEEE from these sectors can be qualitatively different. Besides domestic generation, there can be imports of used EEE and/or WEEE into the country.

Finally, waste enters the waste management segment. In the places where systems for solid waste management are underdeveloped, it is likely that the segment will be dominated with informal actors. These actors extract values from WEEE. Re-usable components are resold in the re-use market, while valuable materials are sent to the secondary material markets, outside the system boundary of this analysis. However, they normally lack a proper means for final disposal of residues from their uncontrolled recovery processes, which in turn, can lead to grave consequences as mentioned in Box 1. To keep the system simple, residue/waste from downstream activities is, however, not shown in Figure 3.

Three EPR components: (1) a formal sector comprising authorised treatment facilities (ATFs), (2) resource flow(s) from the (identifiable) producers to the formal downstream operators, and (3) monitoring and reporting infrastructure, are presented in bold in Figure 3. Regardless of exact programme configuration, these components are necessary to the success of any EPR programmes. The first component ensures that downstream activities are carried out in an environmentally sound and socially acceptable way so that internalisation will adequately reflect true environmental consequences. Henceforth, the term “authorised treatment facility” (ATF) refers to an entity carrying out downstream activities in a controlled manner. The second element is the internalisation of end-of-life consequences to the producers. Preferably the resource flows of a producer should be proportional to the environmental consequences of his/her own products.[7] Lastly, monitoring and reporting mechanisms are in dispensable for the other two elements to be workable.

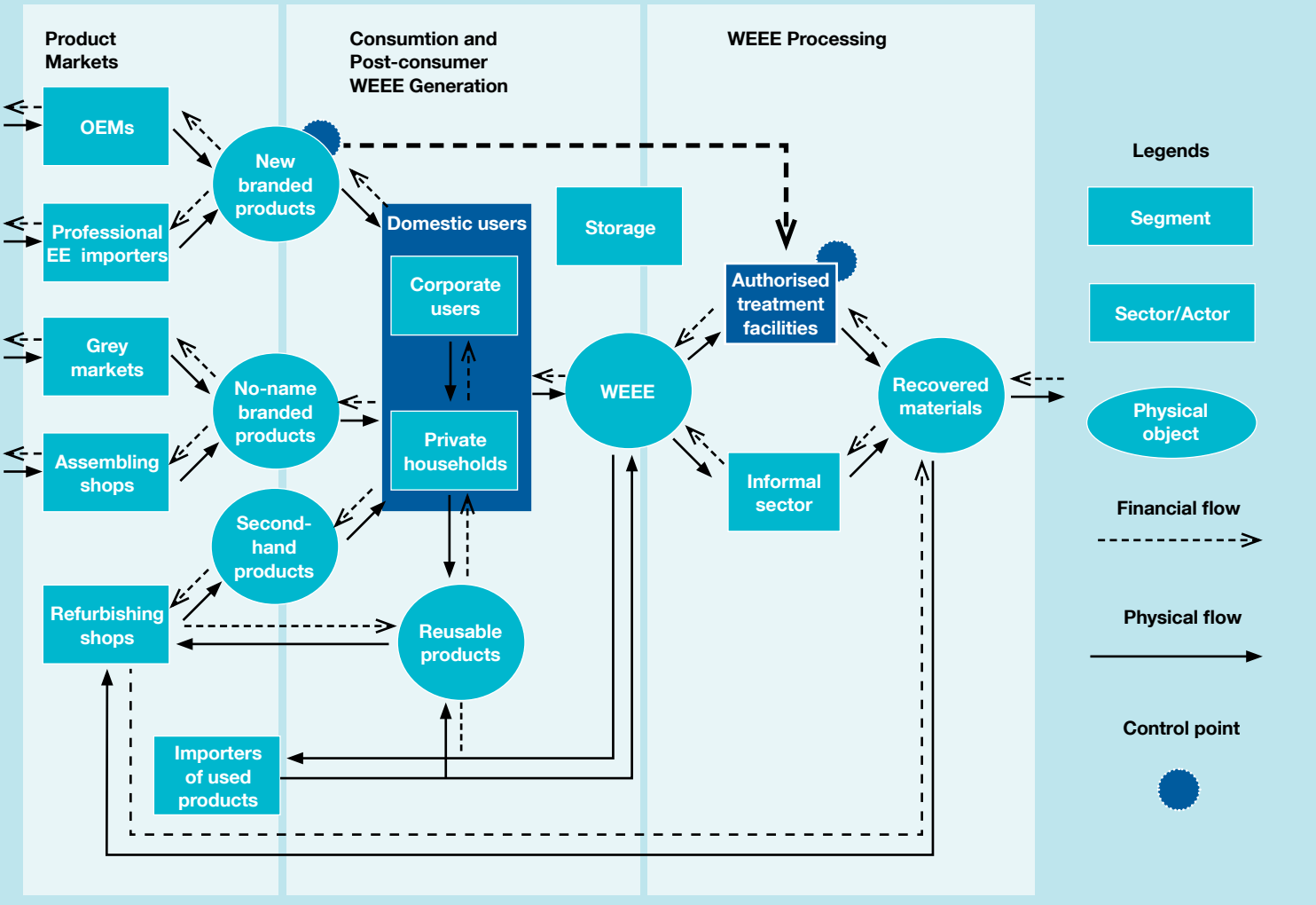
The interplays between contextual factors and EPR mechanisms are key to our policy analysis. Unless a policy, in this case, EPR, matches the social, technological, economic and political contexts, it is likely to result in policy failures (see Dolowitz, and Marsh 2000;

6 Basel Convention on the Control of the Transboundary Movement of Hazardous Waste and their Disposal.

7 The term “resources” in this context is broader than just money and can include end-of-life information of products to consumers (e.g. how to discard waste products properly) and downstream actors (e.g. location of components containing hazardous substances), or even physical involvement in downstream activities by the producers themselves (e.g. at the extreme establishing own collection, and/or treatment system).

Evans 2004). The analytical framework is also proven in our previous projects (Lindhqvist et al. 2008; Manomaivibool et al. 2007) to be useful in assessing the prospect of EPR in a particular non-OECD context in terms of its opportunities and challenges.

Figure 3 A simplified model of an EPR programme in a non-OECD context



3

image Soi Suea Yai community, Bangkok - Electronics are weighed so that the buying price can be estimated

Part 3
Thai context

In our previous work (Lindhqvist et al. 2008; Manomaivibool et al. 2007), we identify possible opportunities and challenges in non-OECD contexts that can be salient to the implementation of WEEE programmes in general and those based on EPR in particular. They are presented in Table 4.

Table 4 Potential opportunities for and challenges to EPR in a non-OECD context

Opportunities	Challenges
Relatively small stock of domestic historical products; Large share of corporate users; Lucrative businesses; Lessening the burden on municipalities; Reinforcing existing business practices and initiatives; and, Harmonisation and learning lessons.	Lack of formal recycling infrastructure and waste separation culture; Competition from the informal sector; Illegally imported and exported WEEE; Identification of producers; and, Design capacity of small-and medium-enterprises (SMEs).

The following sections offer a "reality check" of the Thai context in light of these opportunities and challenges. Instead of presenting manifested opportunities and challenges, the focus of this reality check will be on mechanisms in different segments behind such conditions. These include production and consumption patterns of EEE, status of WEEE management, existing legislation related to EEE and WEEE and its enforcement and the influence of globalisation on the issues at hand.

3.1 Production patterns

An understanding of EEE manufacturing activities in Thailand is an essential starting point for assessing the relevance of issues such as identification of producers and existing design capacities. The production of EEE is one of the largest industries in Thailand. Since the introduction of the import-replacement policies in the 1960s, the electrical & electronic (E&E) sector has grown into a major export sector contributing about one-third of the country's total exports, worth about 46 billion USD in 2007 (EEI 2008). The Electrical and Electronics Institute, Thailand, reports that approximately 500 000 workers were employed in more than 2 000 establishments it surveyed (see Table 5) (EEI 2007). It is worth noting that many small establishments such as independent repairers (see Section 3.2) might not register as a factory and not be included here.

Table 5 Number of E&E factories by types and sizes

Type	Registered capital (million baht)			Total
	<50	50-200	>200	
Electrical manufacturers	556	150	91	797
Electronic manufacturers	468	183	137	788
Traders	155	15	6	176
Repairers	51	6	1	58
Not specified	119	40	29	188
Total	1 349	394	264	2 007

Note: Repairers include services in consulting, testing, calibrating, inspecting, system designing, and other related services appear in the EEI's database.
Source: (EEI 2008)

The strength of the sector lies in manufacturing of electronic parts, products and components such as air conditioners, refrigerators and freezers, hard disk drives, semiconductors, integrated circuits, and printed wired boards This is largely due to the availability of low-cost, semi-skilled workforce, decent infrastructure, and the privilege packages including tax breaks and exemptions provided by the Board of Investment (BoI), Thailand, which in turn, explains why the majority of large establishments are either a joint venture or completely owned by foreign investors, particularly Japanese.

A flip side of this picture is that the upstream industries such as in design, research and development (R&D) have been lagging behind. Most manufacturers are only subcontractors to mother companies abroad (Danish Trade Council 2006). For example, while two Japanese corporations we interviewed have massive production capacities in Thailand for exports, only one of them has an R&D centre in the country and the activities of this centre are limited only to one product group.

This structure of the E&E sector bears some implications to the management of WEEE, especially from an EPR perspective. Mass production of EEE in the country has been a driving force for WEEE recycling. Residues from production including rejected outputs and obsolete inventories have high material value and, currently are what supply existing authorised treatment facilities (ATFs) in Thailand (see Section 3.3). This capacity can be exploited when post-consumer WEEE is regulated in the future. On a more negative note, a lack of design capacity might prove to be a challenge. Herold (2007) finds that the presence of R&D facilities might be a necessary condition for physical engagement of producers in the management of WEEE. Moreover, an effective EPR programme can change the market

structure in a way that favours those manufacturers who are able to develop environmentally superior products and product systems. However, not all manufacturers are equally well equipped to face this new rule of the game. When proposing a WEEE take-back scheme for China, Lin et al. (2002, 575) foresee a side-effect that:

> "The economic opportunities proffered by the implementation of the proposed take-back scheme are more likely to inure to the larger, economically and technologically better endowed foreign-invested facilities than either [Township and Village Enterprises] or the domestic computer production facilities."

Currently, this shortcoming in the E&E sector has been recognised by responsible agencies and there are several capacity building programmes and measures to support R&D in general and product and production design in particular. Nodal agencies are the National Metal and Materials Technology Center, Thailand, (MTEC), National Electronics and Computer Technology Center, Thailand, (NECTEC), and EEI. Ideas discussed with informants from these organisations in the interviews include a national centre of excellence supported by the public sector and working with industries, a model implemented successfully in other East Asian countries. BOI's new scheme providing attractive privilege packages to R&D including exemption of import duty in machinery and eight-year corporate income tax break can also give a boost to the activities (BOI 2008). In addition, educational institutions also play their part in embedding what one informant called "eco-mind" in industrial design curricula.

3.2 Consumption and consumer behaviour

Our previous studies (Lindhqvist et al. 2008; Manomaivibool et al. 2007) show that in non-OECD contexts low penetration rates in the past and a sizable share of large institutional users' consuming products such as computers and copying machines, might present twofold opportunities: a relatively small stock of historical products and manageability. However, in a country like India, unaccountable shipment channels of no-name-branded products represent a serious challenge because EPR is next to meaningless unless the producers can be traced. In light of this finding, this section focuses on the consumption levels of EEE, brand preferences, and product lifetimes in Thailand.

The use of many EEE has become part of the daily live of most Thais and the consumption is in general increasing. Surveys of the National Statistical Office (NSO), Thailand, show that the percentage of households with TV sets increased from 17% to 92% between 1979 and 2003 (NECTEC 2005). The stock of mobile phones can be estimated from the percentage of mobile users, which dramatically increased from 5.6 to 47.2% of the populations aged above six years between 2000 and 2007 (NSO 2008). Table 6 reports domestic shipments of selected products between 2004 and 2007 (computers will be discussed separately below).

Table 6 Domestic shipments of selected products, 2004 - 2007

Products	2004	2005	2006	2007	2008
Air conditioners	955 961	1 241 743	1 381 215	1 466 399	1 843 110
Washing machines	921 674	791 614	1 015 449	1 009 157	1 182 270
Refrigerators	1 239 691	1 283 263	1 266 667	1 167 425	1 400 994
TV sets	2 593 296	2 779 368	3 440 744	3 106 476	2 839 905

Note: These official figures might be underreported due to double accounting, see Section 3.4.
Source: (EEI 2008) based on information from the Office of Industrial Economics.

Regarding the share of products from unaccountable channels, informants in the industries and governmental agencies alike believe that in Thailand black/grey markets are only marginal and limited to certain hotspots, e.g. along the borders, with the exception of counterfeit mobile-phone batteries which are rather commonplace due to their relatively low prices. The market share of established brands seems to confirm this conviction. A review of market intelligence[8] shows that for most EEE the top three leaders in the market account for more than 50% of total shipments.

Tables 7 and 8 report the ownership of personal computers among households and business establishments.[9] Overall, the penetration rates were relatively low and hints at a small stock of historical computers. (For the sake of comparison, when the take-back responsibility of waste computers from households came into force in Japan in 2003, almost all households had a computer(s).) However, the ownership rates are projected to increase. The draft ICT Master Plan (2009-2013) prepared by NECTEC proposes to increase information literacy and accessibility which will eventually lead to more hardware installation (NECTEC 2008). Without a sound end-of-life management plan, however, this well-intended policy can eventually give rise to negative environmental consequences.

8 In the review, we went through leading marketing magazines in the country, to collect scattered intelligence on market shares of selected equipment between 2005 and 2007.
9 Information about the consumption of computers is derived from yearly surveys under the ICT master plans (NSO 2008).

Part 3 continued
Thai context

Table 7 Percentage of households with computers, 2001 - 2006

Areas	2001	2003	2004	2005	2006
Overall	5.1	9.6	11.7	15.5	18.1
Urban		20.6	24.2	30.7	34.4
Rural		4.1	5.6	8.2	10.6
N ('000)		16 017.5	16 652.5	16 786.0	18 061.1

Source: National Statistical Office's Information and Communication Technology Survey.

Table 8 Ownership of computers among business establishments, 2004 - 2007

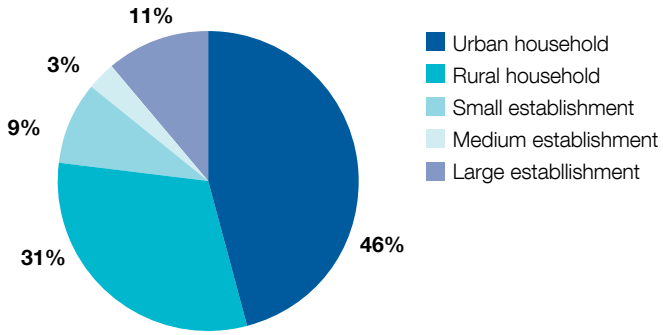
	2004	2005	2006	2007
Est. with comp (%)		20.5	20.5	21.9
No of computers	699 197	831 559	934 060	1 023 429
Ave comp per est.		4.9	5.5	5.7
No of establishments		832 043	827 051	820 137

Source: National Statistical Office's Information and Communication Technology Survey.

A closer look into the ownership pattern reveals the so-called "digital divide" in both sectors. Though the term contains a negative nuance, the divide can be viewed positively in term of the manageability of WEEE generated. The division in the household sector tends to have a similar pattern to that of waste management capacities (see Section 3.3), which concentrates in urbanised areas.

In addition, although far from being dominating as in India, where institutional users accounted for three quarters of total computer shipments, the share of institutional users was still considerable in Thailand. Large establishments with 50 employees or more account for 11% of total stock with an average ownership of 45 computers per establishment, as shown in Figure 4. As can be seen from the cases of voluntary schemes in the lighting sector, these organisations might prove to be very cooperative in take-back schemes. It is not coincident that the two prominent lighting producers started their take-back schemes in Thailand with their large institutional clients. Not only do they have direct business ties with these clients, but they can also get sufficiently large delivery of waste tubes for a smooth operation of their recycling plants.[10]

Figure 4 Number of computers by sectors of population, 2006



Source: National Statistical Office's Information and Communication Technology Survey.

Regarding brand preferences, it is likely that the size of unaccountable shipments in the form of assembled computers might be a little larger than that of other product groups. Based on market intelligence, the combined share of the top three market leaders explain about 40% of estimated total shipments of computers in the year 2005/2006. Although one consequence can be that waste from assembled products will turn up as orphans in an EPR programme, we have argued that this challenge might be more manageable than that posed by products from grey/black markets (Manomaivibool et al. 2007). Assembled computers often consist of components from renowned brands, which can be producers in an EPR programme. Thus, it is possible to not only regulate the final product but also major components of computers.

Another important aspect of consumer behaviour that affects the stock of EEE is product lifetime. As shown in Table 9, EEE can have relatively long life spans in Thailand. This partly owes to repair which is a common feature in Thailand. The country has a huge pool of skilled human resources with the number of E&E technicians of almost a quarter of a million in 2003 (NECTEC 2005). The true number of repairing shops is also likely to be more than what reported in Table 5 by a large margin. For example, one producer lists more than 170 shops in its service network nationwide. Renowned brands normally have their own regional service centres and expand the coverage of their networks through partnership with selected local repair shops. Partnering includes training and certifying to ensure service standards and quality control and discounts for buying authentic components. Besides these certified repairers, there are also a number of independent repair shops which are a preferred option for a product broken beyond its warranty period as they charge significantly less than certified repairers.

10 In the case of governmental agencies which also large users of computers, this might not be so straightforward. Interviewees in the government raise an issue of asset management regulations to our attention. Under existing regulations designed to protect public assets, it is difficult to "retire" durable items and most obsolete equipment is simply hoarded in storage rooms.

Considering their spread and skills, the possibility to incorporate repairers into the management of WEEE, e.g. in take-back and disassembly, should be explored. At the same time, they should also be reckoned as waste generators in the systems. Our visits to repairing shops and interviews reveal that they do not necessary handle residues from repairing processes in an environmentally sound manner. Some small independent workshops do not even have good working environment, e.g. poor ventilation, while working with hazardous substances, which in turn, can has immediate negative impacts on the health of the technicians. It is thus advisable to put more emphasis on health and safety and environmental aspects in vocational education and skill training programmes.

Table 9 Average life spans of selected products in Thailand

Products	Average life span (yrs)
TV set	18.6
Refrigerator	15.1
Washing machine	11.9
Air conditioner	9.2
CRT monitor	9.3
Desktop computer	7

Source: (Kokusai Kogyo 2004, 2-7)

Box 2 Measures to control imports of used products to Thailand

Upon learning about policy developments abroad, Thai policy makers had their concern over potential inflows of low quality, new and used products and WEEE. To control such activities, a package of measures was proposed by the Office of Import Policy Committee, the Ministry of Commerce. The package was approved by the cabinet on 13 August 2003. The Ministry of Natural Resources and Environment (MoNRE) by the Pollution Control Department (PCD), which is also the Focal Point for the Basel Convention in Thailand, has acted as a coordinating body over this issue. PCD also provide necessary trainings for custom officers in this regard.

The first action under the approved framework came from the Customs Department of the Ministry of Finance that issued a notification that employed harmonised system codes for all types of used equipment. This facilitates their separation from new products. Then, with the power under the Hazardous Substances Act, BE 2535, the Department of Industrial Works (DIW) of the Ministry of Industry (MoI) issued a notification on the conditions of imports of selected used E&E appliances on 26 September 2003. In total 29 used products were regulated including air conditioners, refrigerators, televisions, washing machines, computers, copiers, and mobile phones. Imports of these used products were permitted only if the following conditions were met:

1. For reuse: products must be in original shapes and not older than three years from manufacturing date, except for used copiers which can be up to five years. The products must meet respective Thai Industrial Standards Institute (TISI)'s standards and have certificates from the producers or agencies that DIW agreed upon.

2. For repairing: the shipment of products imported back after their repairing abroad must be accompanied by the corresponding export documents. Used products imported for repairing in Thailand must obtain a permit from DIW. Repaired products together with replaced components must be exported out of the country, except the components manufactured in Thailand. In the case that components are not exported, an end-of-life management plan must be submitted to DIW.

3. For refurbishing: the activity must be financially profitable and the imported quantity must correspond with the capacity of the factory.

4. For disassembly or reprocessing: the activity must be financially profitable and the imported quantity must correspond with the capacity of the factory. All imports must be from the Parties to the Basel Convention and comply with the obligations of the Convention.

The notification was effective for the period of three years and was renewed by the second notification when it expired in 2006. On 13 September 2007, the third notification was issued by DIW. The list of regulated articles was expanded to covers 32 used products. There were also changes regarding the conditions of reuse and refurbishing. Under the new procedure, regarding reuse, universal conditions of product ages were provoked. Under the new regulations, each import for reuse must be declared on its necessity to DIW on a case-by-case basis. The product-age conditions (five years for copiers and three years for other products) were, instead, applicable to refurbishing. A source in DIW claims that this move has strengthened the control.

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Thai context

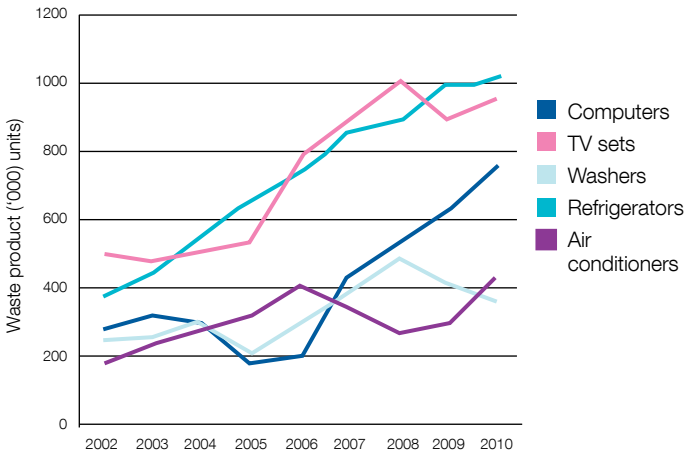
The average life span of some products in Thailand is significantly longer than those in industrialised countries and the difference creates a demand for imports of used products such as computers and copiers. To ensure that environmental benefits from reuse would not be tainted with imports of WEEE for disposals, the Thai governments have taken steps to regulate imports of used products. These measures are summarised in Box 2. The issue of international material flows will be further discussed in Section 3.5.

The figures in Table 9 are also likely to reflect the so-called "hoarding effect" considering the data collection method that sampled WEEE at disposal sites (see Kokusai Kogyo 2004). Products such as TV sets, monitors, and computers do not require a lot of space and can be stored for a few years even when they are no longer functioning. Okada (2001) finds that one reason why people still keep their old products is because they have a mental cost of disposing them. Thus, one solution might be to offer some incentives as in a buy-back scheme to overcome this psychological accounting. This option has been implemented in Taiwan and widely discussed within a Thai WEEE circle (see Part 4).

3.3 End-of-life management

Figure 5 presents projected amounts of selected WEEE in Thailand based on domestic shipment statistics and estimated lifetimes using a batch approach. A more sophisticate treatment of lifetime distribution in the case of TV sets can be found in Oka (2007).[11] Regardless of the sophistication, they show that an increase in consumption of EEE drives WEEE generation. Our informants also subscribed to the idea that product lifetimes get shorter and become a driving force of WEEE generation, although this factor cannot be established with the studies using static lifetimes.

Figure 5 Estimated waste generation of selected products between 2002 and 2010



Source: (Kokusai Kogyo 2004 and EEI 2007)

In the absence of any specific WEEE regulation, the management of WEEE in Thailand falls under two bodies of legislation. Collection and disposal are part of municipal solid waste management (MSWM), which is within the remit of the Public Health Laws. Recovery and treatment are regulated under the Factory Laws, which also govern the production of EEE and the management of industrial wastes.

The Public Health Act, B.E. 2535, puts municipal solid waste management under the authorities of local governments. However, overall coverage and quality of municipal solid waste management in Thailand fall behind waste generation and the variations between local authorities are considerable. For example, the Pollution Control Department (PCD 2008a) estimated that in 2006 only 62% of municipal solid waste in urban and 6% in rural areas was collected and disposed at known disposal sites. Most local governments find municipal solid waste management not being cost-recovery. Although they are allowed under the Public Health Act to charge waste collection fees, local politicians who prefer to subsidise the services from the general budget than to employ economic measures, which can be politically unpopular (Kaosa-ard et al. 2008; see also Manomaivibool 2005).

Currently, most source separation and recycling activities in Thai households are done with private waste dealers. Waste dealers act

11 At the time of writing, there are two new projects on WEEE generation, one using econometric models and the other using material flow analysis (MFA). However, their results have not been published and, hence, cannot be included here.

as middlemen in recycling processes. A survey by PCD in 2003 detected more than 3 000 waste dealers in the country. As shown in Table 10, waste dealers concentrated in urban areas close to their suppliers and clients. It is understood that currently post-consumer WEEE in Thailand is handled by actors in waste dealers' chains on an ad hoc basis as a source of scrap metals and plastics (see PCD 2008b). However, without proper knowledge of this complex waste stream, their cannibalisation is far from optimal both in terms of environmental protection and material conservation.

There are two other kinds of attempts to collect post-consumer WEEE, besides the aforementioned collection through waste dealers' networks: a SKF's programme and voluntary take-back schemes. Suankaew Foundation (SKF) is a philanthropic foundation in connection with Wat Suankaew, a Buddhist temple. In 1994 it started receiving donations of durable used products including used E&E appliances from the public and to an extent it has succeeded in collection via its donation scheme. But it does not have capacities to treat WEEE and, thus, auction donated items to refurbishing and repairing dealers. The story of SKF highlights how trust can play a decisive role for the success of post-consumer WEEE collection. In this case, donors trust the social causes of SKF and are willing to give their used items for free, despite knowing that money will be generated from the donated products. The question is whether an environmental causes, e.g. to ensure that WEEE will be treated in an environmentally sound manner, can create a similar kind of motivations.

Voluntary take-back schemes can be categorised into two: those mandated to the local importers by MNC (multi-national corporation)'s global corporate policies and those developed by the Thai actors themselves. For the former, some global brands of ICT products have offered take-back services in Thailand as part of their global corporate responsibility policies (see Cobbing 2008). However, most of these take-back schemes were at time promotional rather than operational.[12] Take-back schemes developed by local actors seem to be more effective. One network provider of mobile phones started a free take-back scheme for mobile-phone batteries in 2002 and managed to collect some three tonnes of batteries through its 400 outlets in the following year (Kokusai Kogyo 2004). Similarly, the take-back schemes of the two major lighting producers developed by their offices in Thailand are in full operation with one of them even set up its own recycling plant in the country.

Recycling as an industrial activity is under the remit of the Factory Laws. According to DIW (2007)'s database, at the end of 2006 there were 41 factories registered as 105 (sorting and landfill)- and 106 (reprocessing)-types and had businesses relating to WEEE. From descriptions of their business, most can be divided into three groups: preparation for material recycling; repair and refurbishment; and material recycling, as shown in Figure 6. The first two groups comprise of the first movers who seized business opportunities in recycling obsolete components and residues from massive EEE production. However, according to our interviews with experts in the field, there were limitations to material recycling in Thailand in terms of economy of scale and technologies. Several actors, therefore, limited their activities to preparation for recycling and shipped their products for further metallurgic processes abroad (Thangtongtawi 2008).

Table 10 Waste dealers by types of local governments

	No. of waste dealers	No. of local govt.	Waste dealers per local govt.	Amount of recyclables (tonne/day)			
				Average	Max	Min	S.D.
Bangkok	638	1	638	2.76	50.39	0.46	3.62
The City of Pattaya	23	1	23	3.51	16.5	1.02	3.41
Nakorn Municipality	312	22	14	2.17	177.3	0.06	10.11
Mueng Municipality	671	110	6	1.24	20	0.01	1.38
Tambon Municipality	1 475	1 024	1-2	0.88	8	0.00	0.86
Overall	3 119	1 158		1.49	177.3	0.00	3.72

12 As part of its ranking, Greenpeace International cross-checked with the companies' offices in Thailand (and other non-OECD countries) and discovered that some did not "walk the talk" (Cobbing 2008; see also Greenpeace International 2008).

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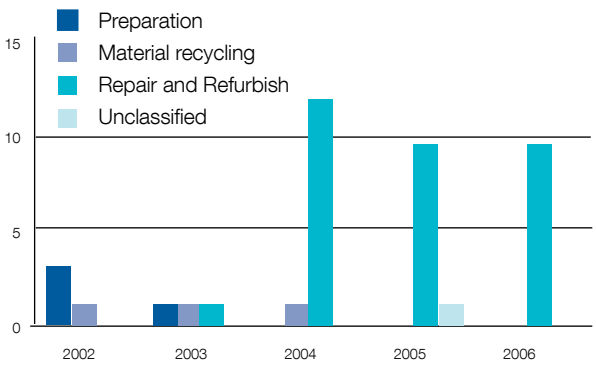
Thai context

Figure 6 Number of WEEE facilities in operation in 2006 by years of registration



Source: (classified from DIW 2007)

However, the existing 105-and 106-type factories have played only limited roles when it comes to WEEE from domestic consumption. The management of post-consumer WEEE demands well-planned collection and flexible dismantling systems to cope with its non-point sources and heterogeneity nature. From the interviews, there are several investors who express their interest in post-consumer WEEE recycling in Thailand, but at this moment they are waiting to see a clearer picture of the Thai WEEE policies.

In the future, a national EPR programme for WEEE can lessen the burden of local governments in managing this waste stream. Resources and expertises of producers and other economic actors can be used to establish downstream infrastructures that are currently missing. A clear policy to support WEEE recycling with resources mobilised within the programme can reinforce investment interest in the activity. A dedicated WEEE programme can also spearhead and formalise source separation practices among Thais and spill over to the management of other waste streams.

3.4 Law enforcement

Besides the three physical segments already discussed, law enforcement can play a decisive role in any EPR systems. One of the main conclusions from our previous study is that EPR relies on market-based mechanisms and anomalies in a market economy, such as illegal or informal sectors, can undercut its prospect (Manomaivibool et al. 2007). This section thus examines key aspects of existing laws and their enforcement in Thailand. We frame the discussion in accordance with a typology of policy instruments outlined in Section 2.6.

As shown in Figure 7, several pieces of legislation regulate different parts of EEE's life cycle in Thailand. Most follow the so-called command-and-control approach to control certain economic activities through administrative instruments. For example, factories register as type 101, 105 and 106 are all Class 3 factories, which need to obtain a permit from the Ministry of Industry (MoI) before operation. It is worth noting that their authorisation also includes an environmental impact assessment (EIA).The Factory Act also controls waste generations from factories. In a nutshell, generators of industrial wastes must not store wastes for more than 90 days and have to obtain a permission to send wastes to authorised treatment facilities (i.e. 101, 105 and/or 106) to which transports are controlled under the manifest system. Where wastes are classified as hazardous substances, they fall under stricter requirements of the Hazardous Substance Laws.

However, the enforcement of these requirements is often lax. Factory inspection is a function devolved from DIW to provincial industrial offices (except for some sectors where DIW still retains direct control). DIW has standardised inspection procedures, for example, by issuing type-specific manuals for the inspection of landfill activities of 105-type factories (DIW 2006). Nevertheless, all interviewees asked agree that the level of inspection is far from satisfactory and cite insufficient resource as a major constraining factor. Interviewees from the industries complained that this restricted the authorities to focus on "good" factories that dutifully report their activities because the authorities know more about the good ones. This however creates a perverse incentive for actors to staying outside and avoiding or under-reporting their activities, if possible. Furthermore, environmental NGOs argue that industrial officers often prefer to impose lenient measures such as issuing a warning than inflict sanctions on factories. This is in line with a finding that no administrative fine under Article 82 of the National Enhancement of Environmental Quality Act has ever been imposed (Kaosa-ard et al. 2008). In addition, the size of sanctions as set in an Act is rarely subject to any periodic review and can be outdated.

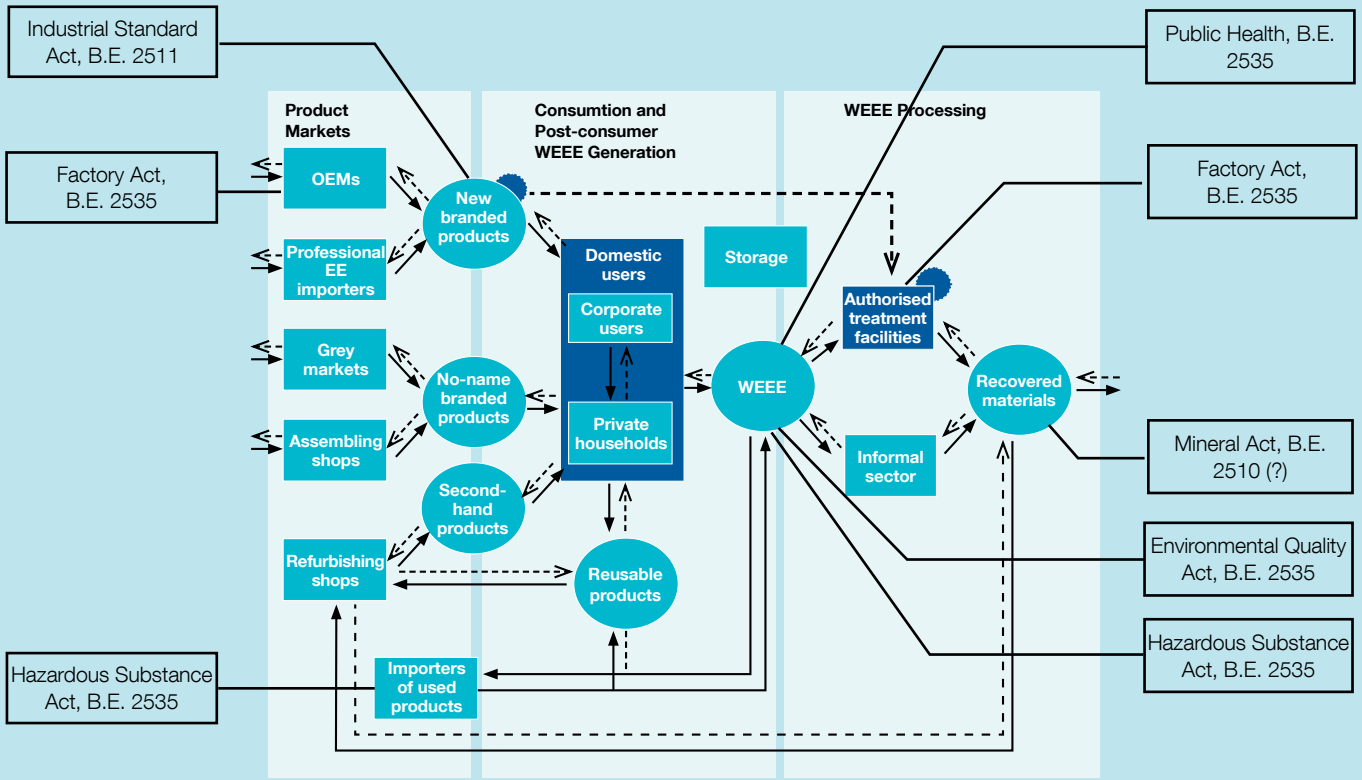
There is also an issue of the scopes of and coordination between command-and-control regimes. For example, the Factory Act is only applicable to factories defined by law as an entity with engines of more than five horsepower or seven workers in industrial activities. It does not cover waste treatment and disposal activities carried out by local governments or activities of the majority of waste dealers. It is not uncommon to hear people from waste management industries mention about fierce competition and price war with municipal "holes" (dumpsites). In addition, there is confusion, at least among industrialists, on to what extent the Mining Act as enforced by the Department of Primary Industries and Mines is applicable to material recycling processes. One interviewee who has been in waste management industries for more than 30 years aptly sums up the

situation that: "The laws [in Thailand] are based on the principle of division but they lack a holistic view. Therefore, in practice, different agencies work on their bits but not in a concerted manner. They respect each other's domain but do not coordinate."

With the shortcomings of a command-and-control approach, there has been a strong interest in economic instruments for environmental management. All proposed models of a Thai WEEE programme have some kinds of fees, taxes, or deposits and refunds (see Part 4). Their proponents highlight the dynamic nature of incentives provided by economic instruments that in theory can induce economic actors to adjust their behaviours in a way beneficial to the environment. Nevertheless, as of administrative instruments, the actual effectiveness of economic instruments is contingent on their policy contexts.

Although there have not been many economic instruments deployed for environmental purposes in Thailand, a review of these few experiences can throw some lights on the context-dependent nature of policy instruments. To be able to provide incentives for behavioural changes, economic instruments must create significant variations in financial consequences attached to different behavioural options.[13] On the other hand, waste collection fees are normally flat in each locality and hardly influence households' waste separation and disposal behaviours. Waste collection fees also fail as a cost-recovery tool. As mentioned above, what is considered politically feasible might not coincide with the optimal level in an economic textbook and the feasibility space in a local policy might be much smaller than in national politics. Local governments also suffer from low revenue-collecting capacity. With this in mind, the Thai WEEE policy is going to be formulated top-down with uniform fees set

Figure 7 Regulatory regimes along the life cycle of EEE in Thailand



13 Differentiated excises applied to leaded and lead-free gasoline in the past and recently to gasoline and gasohol are good examples in Thailand which saw changes in consumers' purchasing choices.

and collected at a national level before transferred to operators at a local level. Regarding the transfer mechanism, a lesson should be learnt from the National Environmental Fund. The fund was erected based on Section 2 of the National Enhancement of Environmental Quality Act and was supposed to be a mechanism where revenues from charges and fees collected under the Act could be allocated and reinvested in environmental protection projects. In practice, a discretionary and cumbersome application procedure has left the fund underused with the amount of uncommitted fund standing at around 3 800 million baht (Kaosa-ard et al. 2008).

Last but not least, the role of information should not be overlooked. Here we focus on one instrument: reporting to authorities. Reporting duties have been an integral part of most, if not all, regulatory regimes. However, as with their administrative siblings, in practice they have not been followed dutifully. Deviations range from a-tendency-to-underreport to not report at all. It is brought to our attention during interviews that production statistics might not be so reliable due to the practice of "double accounting" where factories underreport their activities to authorities.[14] We have also learnt that 105- and 106-type factories do not always register as a waste generator and report wastes from their waste treatment processes. A claim that recovery processes are waste free seems to defy the laws of physics. It also contradicts legal requirements, particularly for the 106-types whose permits do not cover waste disposal activities. This anomaly was serious forcing DIW issued orders dated 24 May 2007 stressing that final wastes from waste treatment activities are subject to similar requirements as those from other waste generators.

As known in the quality management circle: "what is measured gets managed", unreliable information can mislead the management. For example, part of the discrepancies in inventory studies as mentioned in Section 3.3 can be traced back to a lack of reliable domestic shipment statistics. In informal discussions with the researchers of WEEE inventory projects, we find that not only did their models differ, but also the inputs into the model (e.g. one used multiple sources of information, one calibrated official statistics, and the other tried to get real data from factories). Getting information right will be essential in the future with the proposed economic instruments, which in turn, renders the database development project in the Thai WEEE Strategy (PCD 2007) all the more important for the viability of the system.

3.5 Globalisation

Globalisation has become an integral part of the Thai context. We have seen in Section 3.1 that E&E production in the country is strategically fuelled by foreign direct investments and exports. Looking at the consumption, MNCs' brands dominate the markets of most product groups. There is also an issue of international reuse strategy where used products flow from developed to developing countries. Even in the waste management segment, there is a trace of internationalisation, e.g. when intermediate products are shipped for final refinement abroad, not to mention illegal imports/exports of WEEE. Under this circumstance, international developments regarding EEE flow and WEEE management unavoidably affect the Thai landscape and vice versa. This section offers an overview of such interconnectedness in relation to its implication to the potential opportunities and challenges introduced in the beginning of this section and to Thai policy development discussed in Section 4.

As showed in Figure 8, several blocks of countries have had some kinds of WEEE-relating policies. The most renowned case is the European Union (EU). Its twin Directives was enacted in 2003. Switzerland and Norway, which are outside the EU, have comparable statutes. Similar policies (albeit with different approaches) can also be found in the North East Asian region. Japan and Taiwan had their laws enacted at the end of the 1990s and South Korea in the early 2000s. Recently, China (mainland) just passed its WEEE ordinance in the mid-2008 (Xinhua 2008) after issuing administrative measures on hazardous substances in electronic information products in 2006. In North America, we see a state/provincial approach where state/provincial governments take initiatives in an absence of national legislation.

Effects of this international policy convergence on Thailand can be felt from two fronts: products and wastes. First, restrictions of the use of certain hazardous substances (RoHS) in EEE can lead to structural changes in production and consumption. Impacts on the former have already been evident as producers and suppliers in Thailand have to comply with new demands in global supply chain networks (see TEI 2003). Influences on consumption are not as automatic. We have argued that the way some RoHS legislation is written would hardly affect the characteristics of products consumed elsewhere (Manomaivibool et al 2007). Nevertheless, it is worth noting that, although RoHS has not been compulsory yet in Thailand, some producers start to offer RoHS-compliant products and advertise them as environmentally superior products.

Secondly, it is possible that when a country starts to regulate and demand stricter standards on WEEE treatment and recycling, a side effect is an outflow of WEEE and/or used products to other countries with less stringent environmental standards. This so-called pollution

14 While revenue collecting agencies in the Ministry of Finance might be capable to collect taxes and fees from reported tax bases, both industrial and environmental officers and informants from industries mention that the tax bases themselves can be distorted because the loopholes in inspection and auditing allow factories to report a false account to the authorities in an attempt to evade their financial duties.

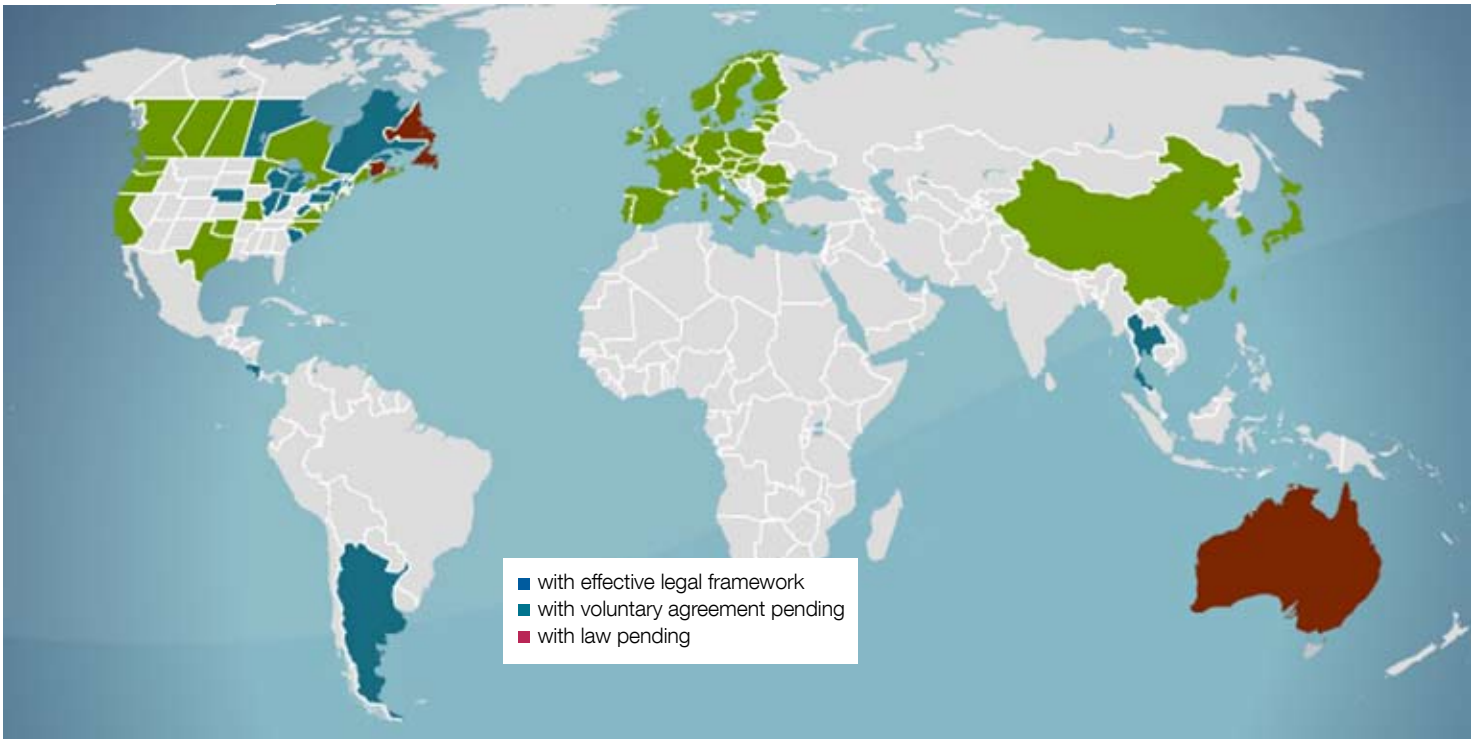


Figure 8 WEEE policies from a global perspective

heaven hypothesis does hold some water. Most studies have reported collection rates of around 50% or (much) below in countries with WEEE programmes (see, for example, Cobbing 2008; Oguchi et al 2008). If the unaccounted goes to countries without proper WEEE management systems, this would result in double loses – a lost opportunity in the country of origin and a damage in the recipient. This conclusion might also be true for international reuse that, unlike WEEE, is legal in most of the cases. Truttmann and Rechberger (2006) demonstrate that, from a material flow perspective, reuse is a sound strategy as long as there is no trade-off with recycling, in which case, the lost in the latter can easily outweigh the benefits of the former. When this is taken in account together with acute adverse damages that can result from uncontrolled recycling (see Box 1 in Introduction) the verdict seems clear.

As a matter of the fact, the concern over influxes of inferior products and WEEE to the country was a prime mover that started off the WEEE policy discussion in Thailand (PCD 2007). According to DIW, official statistics of illegal imports of used tyres, used electrical parts and used lead acid batteries stood at 150 tonnes and that of illegal exports of WEEE that were returned from China and Hong Kong at 80 tonnes in 2007 (Thangtongtawi 2008).

On the bright side, existing policies in other jurisdictions provide a very rich soil for lesson drawing, as can be seen from a comparison of selected programmes in Appendix III. Thailand can benefit from trial-and-error processes – that other countries and jurisdictions have gone through – and does not have to start making a policy from scratch. For example, although the country has only limited experiences on economic instruments for environmental management, it can study various financial arrangements in existing WEEE programmes. The fact that pioneers have adopted different mixes of policy instruments allows succeeding countries to examine strengths and weaknesses of different approaches.

Another area that a policy in Thailand can easily and should be harmonised with is RoHS. In early 2008, the Thai Industrial Standards Institute, MoI (TISI) issued the so-called Thai RoHS Standards. However, the standards are at this moment voluntarily and normally it takes a few years for voluntary standards to turn into compulsory ones. Two interviewees view this gradualism diversely, though both views somehow rest upon the competitiveness of Thai industries. One sympathises with the government's concern over the impacts of such standards, if being mandatory, on the industries, especially on the production costs and hence price competitiveness. The other, however, does not see much value-added in spending years to issue voluntary standards as awareness has long been raised and the

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majority of the industries have been hit by the foreign standards15. His concern is that this will simply leave the laggards locked into production technologies soon obsolete in the global market.

There are international actors that have been playing a role of enabler in sharing experiences.. Intergovernmental bodies such as the Organisation for Economic Co-operation and Development (OECD) and the Secretariat of the Basel Convention have commissioned a number of EPR and WEEE studies, respectively, and play an active role in disseminating information. The former even published an EPR guidance manual for governments "to provide information to national governments that may wish to establish EPR policies and programmes" (OECD 2001, [15]).

There is also bilateral cooperation between developed and developing countries. In this respect, most aids in EEE/WEEE areas to Thailand have come from Japan and the EU. For example, the first WEEE inventory study in Thailand was financed through the Green Aid Plan (GAP, now Green Partnership Plan, GPP), which was a partnership between the Ministry of Economy, Trade and Industry (METI, Japan) and MoI (Thailand). Aids often included knowledge sharing with experts from Japan or the EU and study visits. Interviews with those who have been involved in these schemes show that they have a good understanding about the systems in Japan and in some EU member states, (namely, Germany, the Netherlands, Belgium, and Austria). Some are also aware of the Korean system, although to a lesser extent. However, virtually none possesses such knowledge of the (product-or advance-) fee-based systems in Taiwan or in some North American states. Considering that most policy proposals in Thailand suggest such a model for Thai WEEE, this is somewhat a mismatch (see Part 4).

Last but not least, we should not forget MNCs. MNCs that have markets in Thailand have developed capacities to deal with their end-of-life responsibilities that are extended in various ways in different countries. Lin et al (2002), thus, suggest that these companies should be able to facilitate the transfer of technologies and know-how if required. In addition, some producers have come out and subscribed to the IPR principle which is put into operation in a form of global take-back policies.

However, one should be cautiously optimistic about this. Previous studies show that producers' strategies vary according their views on the prospect of policies (Manomaivibool 2007; Crotty, and Smith 2006). We find that all producers interviewed, except one, feel uncertain that the draft legislation would be passed into a law within the timeframe stipulated in the Strategy, i.e. by 2011. They appear to follow a wait-and-see strategy and none has been in active consultation with the government concerning hitherto policy development (one company refers to indirect participation via collective bodies such as the Federation of Thai Industries (FTI) and the Thai Chamber of Commerce (TCC)).

15 One survey among Thai industries reported in (Thangtongtawi 2008). shows that the ROHS Directive of the EU has direct impacts on 74% of the respondents with another 12% bear indirect impacts. Interestingly, the same survey shows that almost 80% of the respondents want the government to enact RoHS-like law – a very high percentage that easily bring the measure to the top of the list of desirable supports from the government.

4

image Soi Suea Yai community, Bangkok - Printed wiring boards (PWBs) are dismantled by bare hand before being sold

Part 4
Thai WEEE Policies

In light of the existing situation discussed in Section 3, what has been the policy response of the Thai government? In this section, we describe and analyse the policy development process related to WEEE in Thailand as well as the overall picture of the developed policy. In order to avoid duplication, details of the components of the policy are introduced in Section 5 when relevant.

4.1 Policy Background

Policy development in Thailand started as a response to the policy development in the EU, which brought the WEEE issue to the attention of Thai policy makers. The Department of Foreign Trade, the Ministry of Commerce, led the way informing others about the development and an inter-departmental committee was formed in 2000 to follow the impacts of the upcoming EU policies such as Integrated Product Policy (IPP), the WEEE and RoHS Directives. Within this framework, a study was carried out by the Thailand Environment Institute (TEI) to investigate the impacts of EU policies on Thai industries (TEI 2003). A spill-over effect of this awareness raising was the activation of agencies such as the Pollution Control Department (PCD), the Department of Industrial Works (DIW), the Electrical and Electronic Institute (EEI), and the National Metal and Materials Technology Center (MTEC) that, later, became leading figures in Thai WEEE policies.

To form a basis of future policies, studies were commissioned to explore different aspects of WEEE management (or a lack of it) in Thailand at the beginning of the 2000s. PCD with Japan External Trade Organisation (JETRO) made the first WEEE inventory study in Thailand (Kokusai Kogyo 2004), of which, some of the findings are presented in Section 3.3. PCD also commissioned the Social Research Institute, Chiang Mai University (SRI), to make a study on a draft law. The research team consisted of legal experts and economists reviewed laws governing hazardous wastes in the EU, Japan, and the United States and the Basel Convention, and legal and practical aspects of the hazardous waste management, including WEEE, in Thailand. They also solicited opinions from stakeholders in Thailand via interviews and focused groups. The final report (SRI 2004), which came out in 2004, proposed a model combining product fees with a buy-back scheme managed in a national fund for the management of hazardous wastes from used products. It also suggested that the roles and the resources of local governments should and could be strengthened under the financial arrangement. As will be seen shortly, these points were later followed closely in the PCD draft. In the meantime, DIW performed a feasibility study on WEEE treatment plants and concluded that (a) recycling centre(s) and (a) disassembly plant(s) needed to be established in the country. The required capacity would need an investment of a few hundreds million baht which could be recovered from charging product fees (Jairang-sri 2006).

Based on these early studies, the fee-based management model has moved to the centre of the Thai WEEE policy circle. It was proposed in both draft Acts that were developed by DIW and PCD. From the interviews with key informants involved in the drafting processes, the two differed on the purpose of collected money and how it would be managed. While it would be used directly to subsidise a national buy-back scheme and treatment activities under the PCD scheme, the money would act as a deposit in the DIW scheme which would be refunded to producers in relation to their recovery (collection and treatment) performance. The DIW draft, however, had a short life. According to our interviewees, it was unpopular in the hearings with local manufacturers who preferred the government to assume the physical responsibilities. Thus, it was not developed further and only its PCD counterpart went into public consultation.

4.2 The PCD's Draft Act

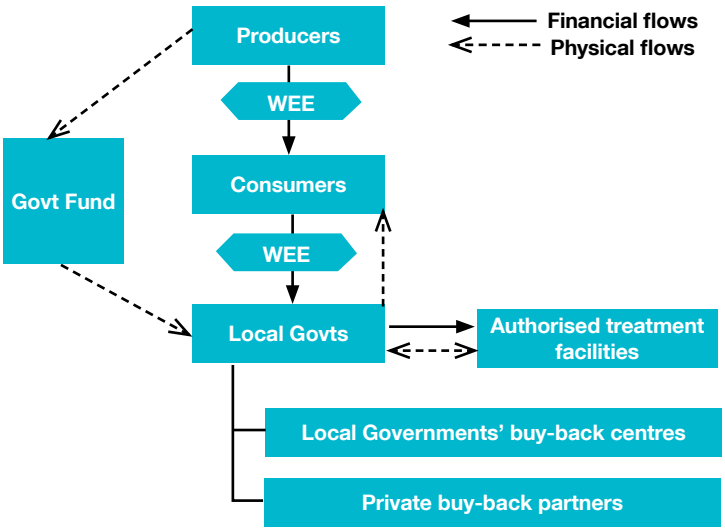
The draft Act on the Promotion of the Management of Hazardous Waste from Used Products (henceforth the PCD's draft Act) appeared to the public for the first time in March 2005 and was amended at least twice in June 2005 and February 2006. The draft Act proposed a cost-recovery system where fees levied on regulated products at the point of sales would be used in the end-of-life management when the products become waste. Although the official list of regulated products had never been developed, it was understood that in the beginning major EEE items such as refrigerators, washing machines, unit-type air conditioners, TV sets, and computers would be included together with other product types like tires and batteries.

Figure 9 presents a simplified picture of the proposal. In the system, fees would be levied in a similar manner as excise taxes or custom duties, in the case of imported goods, on regulated articles. Part of the money would be used to buy back waste items from end users. A governmental fund and a fund committee would be erected under the Ministry of Natural Resources and Environment (MoNRE) to oversee the system. The power of the committee included advising the Ministry in setting the scope of the system and the levels of product fees and buy-back rates. Local governments at the provincial level would still be responsible for physical waste management but could get reimbursement from the Fund.

4.3 The Thai WEEE Strategy

In 2004, PCD and the Office of Industrial Economics, MoI (OIE) formed a taskforce to develop a Thai WEEE roadmap with other governmental agencies. This taskforce replaced the inter-departmental committee under the Ministry of Commerce, which discontinued after the change in governments in 2001. According to key informants who involved in the taskforce, the body helped

Figure 9 A proposed system in the PCD's Draft Act



bridging fragmented work carried out by different agencies after the inter-departmental committee ceased its function. The draft Thai WEEE Strategy was proposed to the National Environmental Committee for the first time in July 2005. Since then, the draft had been amended several times in the negotiations between MoNRE and MoI before the final version was approved by the cabinet on 24 July 2007.

The National Integrated Strategy for the Management of Waste Electrical and Electronic Equipment (henceforth, the Thai WEEE Strategy) outlines rationales, objectives and policy targets, responsibilities of different agencies, and timeframes for Thai WEEE policies. It follows the precautionary and polluter pays principles and has five objectives:

1. "To manage domestic post-consumer WEEE in a scientific and systematic manner;
2. To establish an efficient and sustainable WEEE management system with cooperation from every sector of society;
3. To reduce hazardous wastes from EEE at the origin and to encourage environmentally friendly design and production;
4. To enhance the competitiveness and negotiation power of the country in international trades; and,
5. To have nationwide efficient and effective integrated WEEE management by 2017" (PCD 2007, 26).

The Thai WEEE Strategy suggests an incremental approach starting with pilot projects in well-selected areas followed by the enactment of an overarching legal framework expected in 2011 before the system reaches its maturity in 2017. It also stipulates interim targets of having collection and recovery rates of 50% of WEEE arising and one community hazardous waste treatment plant by 2011. Moreover, five strategic areas: technological development, capacity building and awareness raising, legal development and law enforcement, economic and financial measures, and managerial development, are identified together with operational measures and implementation plans in each area. A steering committee, known as the Thai WEEE committee, was appointed under the National Environmental Committee to oversee the work carried out under the strategy.

The interviews with governmental agencies indicate that relevant agencies has been followed the plan in the strategy as closely as possible, despite some delays due to political challenges in recent years. However, it is now unlikely that the PCD draft would be enacted as a stand-alone Act. The Fiscal Policy Office (FPO) of the Ministry of Finance (MoF) recently drafted a law on economic instruments for environmental management and successfully persuaded MoNRE to revise the PCD draft Act into a subordinate law, a Royal Decree, under its new draft Act. This development was confirmed in the third meeting of the Thai WEEE Committee (Thai WEEE Committee 2008) and will be the focus of the last section of this part.

4.4 The FPO's draft Act

The new draft is the draft Act on Economic Instrument for Environmental Management (henceforth the FPO's draft Act). It is an offspring of FPO's two-phased project carried out within a four-year ministerial strategy (Fiscal Year 05 - Fiscal Year 08). The project was supported by the Asian Development Bank (ADB) as a Technical Assistance project. In the first phase, the project surveyed international and Thai experiences with economic instruments in environmental management. It concluded that this type of instruments were underused and recommended a way to advance the use of environmental taxation in Thailand (Kaosa-ard et al. 2008). The second phase picked up where the first phase ended being a project to develop a draft law to enabling the use of economic instruments for environmental purposes. It is worth noting that the second phase of the study was lead by researchers from the Social Research Institute, Chiang Mai University (SRI), who were instrumental in drafting the PCD's Draft Act.

The following description of the FPO's draft Act is based on the reading of its earlier draft. It is expected that the draft will be revised after hearing and consultation processes which are under way. At the time of writing, there are also several areas that remain contentious, e.g. whether fee rates have to be stipulated in the mother Act (under legislature power) or they can be specified in subordinate Royal Decrees (under administrative power).

Part 4 continued
Thai WEEE Policies

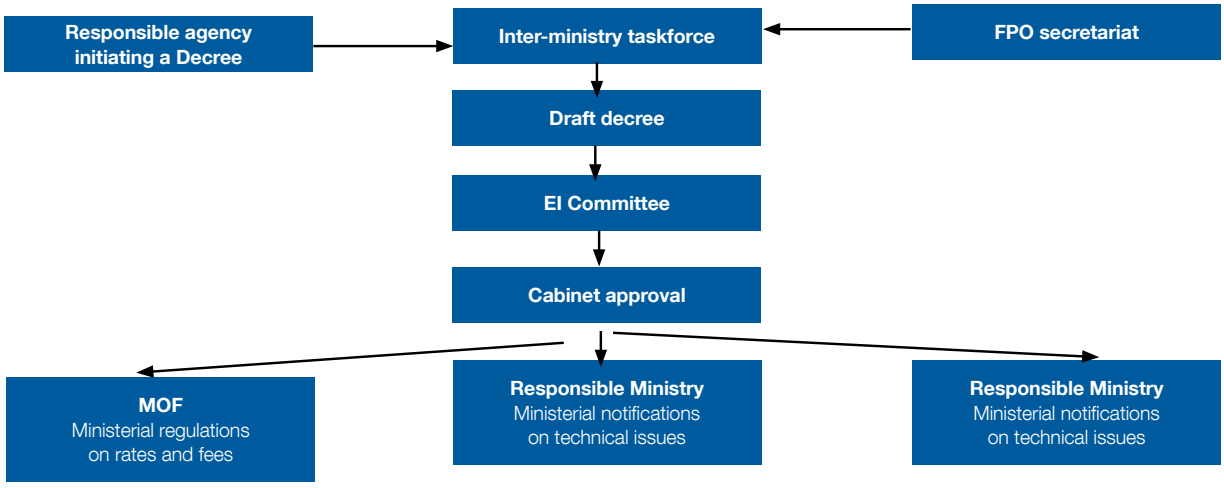
The FPO's draft Act will be an institutional framework for the use of economic instruments to environmental ends. It covers not only taxation but also other five economic instruments: user fees and charges, product taxes and surcharges, performance bonds, tradable permits, and subsidies and other favourable treatments. It also proposes an establishment of a new national fund under MoF to manage revenues derived under the law. The draft, however, does not define in details how the fund will look like, besides that a professional bank or a financial institution can be appointed as its manager. According to the report of the second phase confirmed by our interviews, it is likely that revenues from different sources will be earmarked under different accounts within the fund.

The act itself does not bring any of these instruments to life; rather it provides procedures and conditions enabling other agencies including local governments to develop a proposal in collaboration with FPO to deploy a specific instrument. A national inter-ministerial committee, named "the Committee on Economic Instruments for Environmental Management Policy" (henceforth the EI Committee), will be elected to make a decision over proposals. The EI Committee will be chaired by MoF with FPO as a secretariat. Figure 10 presents the institutional arrangement as proposed in the draft. The draft Royal Decree on Pollution Tax on Effluent Discharging of Biochemical Oxygen Demand values and Total Suspended Solids (also known in short as the Royal Decree on Water Pollution Taxes) was a co-product of the ADB-funded project and is going to be the first example of subordinate laws. Currently, FPO is working with DIW to draft another decree on selected air pollutants and with PCD on the product fees, which, is basically a modified version of the PCD's draft Act.

From our interviews, there are several issues that need to be resolved before the system proposed in the PCD's draft Act can be accommodated within the institutional framework of the FPO's draft Act. The management of revenues is one of them. Although the details of the fund have not been finalised, FPO emphasises that the reserve in the fund should be reasonably low as it represents an extraction of resources from the economy and prefers a simple mechanism like a so-called pay-as-you-go (PAYG) system.[16] It also envisions an arrangement that allows money to be transferred from one account to another in order to enhance spending flexibility and keep up with changing environmental problems. On the other hand, PCD prefers a more closed cost-recovery system and would like to keep open the option of financial guarantees, where fees collected from products put on the market today is reserved for their end-of-life management in the future.

These contentions can be understood from the differences in objectives and missions of the two key agencies. PCD, on one hand, is searching for a way to address the WEEE problem. FPO, on the other hand, has its interest in ensuring the integrity and unity of fiscal policies of the country. The domains of the two converge simply because the means identified by PCD to achieve its ends is the use of economic instruments which is part of fiscal policies.

Figure 10 Institutional arrangement under the FPO's draft Act



Source: (Kaosa-ard et al. 2008, 103)

16 In a PAYG system, fees levied on sales of new products will be used to finance the management of waste arising in the same year. This is similar to a pension system where the current active workforce pays the benefits of current pensioners. For products with long life spans, technological shifts or changes in lifestyles can disrupt the PAYG mechanism because there are fewer (or no) newcomers into the system to pay for the end-of-life costs of old stock. A notable example is an electrical typewriter.

5

GREENPEACE/ VINAI DITHAJOHN

image Soi Suea Yai community, Bangkok - Discarded electrical appliances, TV monitors and computers are being stacked to await dismantling

Part 5
Policy Analysis

The part analyses the policy development in Thailand. The analysis follows the framework developed in our previous works which focuses on six themes central to the translation of the EPR principle into legislation. They are: the legal and administrative structure, the programme's scope, institutional users and private households, the definition of producers and their responsibilities, a level playing field between compliance schemes, and provisions for non-compliance. As themes are quite various, each section starts with a short general introduction to issues in a respective theme before we proceed to the analysis.

5.1 Administrative fragmentation of life cycle phases

EPR is based on life cycle thinking, and ideally existing institutions should take environmental considerations into account in a holistic fashion (Heiskanen 2002; Weale 1992). In practice, the institutions for production and end-of-life management are separated. This is reflected in legal structure, in which there exists one set of regulations governing manufacturing, and another for solid waste management. Therefore, a full translation of EPR into laws requires a lot of coordination between these authorities (and others). However, there is an upside to this administrative fragmentation. The division of labour allows a government to treat and prioritise manufacturing issues and solid waste management issues on an individual basis.

As can be seen in Part 4, the thesis of administrative fragmentation holds much water in the case of Thai WEEE. It does cut across the jurisdiction of several independent authorities, which sometimes work in competition with each other. The good news is that there have been attempts to coordinate their actions and create synergies. A notable example is the PCD/OIE taskforce, which eventually produced the Thai WEEE Strategy, which in turn, will coordinate future medium- and long-term actions of various agencies. The positive effect of division of labour is also evident. While the processes of drafting a new end-of-life law has been time-consuming, the processes of regulating imports of used products and developing product standards (e.g. RoHS) within the existing frameworks were considerably shorter.

Unfortunately, the policy development has also experienced the downsides of the fragmentation. Agencies often stick to their well-defined but narrow (from a life cycle perspective) missions. Consequently, crosscutting mechanisms can be overlooked. For example, although encouraging DfE is mentioned as one of the overarching objectives of the Thai WEEE Strategy, it has a tendency to disappear at more operational levels of WEEE management. In addition, agencies are not automatically cooperating when facing a crosscutting issue. Sometimes, they are caught up in the so-called turf wars and have to spend their attention and energy in resolving jurisdiction conflicts, instead of in making real progress. However, one should not forget that the word "integrated" as in the title of the Thai WEEE Strategy should imply more than an additive effect of policy components, in this case, product and waste policies, but also their interactive impact. (As often said that synergy is 1+1=3.) As Lifset and Lindhqvist (2008) discuss, unless such an inter-life-cycle-phase link is specified, the case of shifting end-of-life responsibilities to the producers is not so convincing.

5.2 Scope of legislation

In its totality, EEE comprises a long list of equipment dependent on electric currents or electromagnetic fields, and the list can be extended to include equipment for the generation, transfer and measurement of such currents and fields. In addition, most systems cover all components, subassemblies and consumables of respective EEE, but exempt equipment that is designed specifically as part of another product, e.g. EEE in vehicles, and those for military and some specific purposes.

In general, there are two approaches for defining the scope of EPR programmes for EEE, each with its own advantages and disadvantages. The first one can be called a comprehensive approach, as adopted in the EU, Switzerland and Norway. Here, a broad definition of EEE is given and all equipment with such characteristics is covered. In addition, the EU Directives also introduce a system of product categories dividing EEE into ten categories according to their major characteristics, e.g. size, function, main application, etc. The second is a selective approach where a few categories of EEE are selected based on certain criteria. Non-European systems follow this approach, and among the first targeted EEE are video display devices (e.g. TV sets and monitors), refrigerators and freezers, unit-type air conditioners, washing machines, and personal computers and laptops. In these systems, it is generally possible to add more EEE into the scope through secondary laws such as a decree or a ministerial order.

The advantage of the comprehensive approach is its holism, which guarantees the applicability to all EEE. In addition, from the consumers' perspective, it can lead to a convenient collection system because the system accepts all types of WEEE. Nevertheless, this approach does have a drawback in terms of administrative complexity, as having many products with very different characteristics requires a high level of flexibility and variation within the system (see Huisman et al. 2007). This would eventually lead to cross-subsidisation between product groups.

The strengths and weaknesses of the selective approach are the opposite. The major advantage of the approach is the ease of administration, possibly with incremental improvement and expansion over time. Its main disadvantage is higher 'cost of

policy inaction' (Bakkes et al. 2007) as the regulatory stimulus for the products outside the scope is, at best, weak. For example, the elimination and/or substitution of hazardous substances in selected products might fail to transfer to similar applications in other products. In addition, Oguchi et al. (2008) demonstrate that for over 90 product groups that were not included in the recycling programmes in Japan 80% or 460 000 tonnes could be classified as unaccountable flows. This is one of the reasons why some established systems, such as those in Korea and California, are moving towards the comprehensive approach.

A hybrid approach - which can capture the advantages of both – is, however, possible, especially if we appreciate the aforementioned institutional fragmentation. As the advantages of the comprehensive approach are in the manufacturing phase, while those of the selective approach are in end-of-life management, the system can be comprehensive when it comes to production requirements, and selective in the products its end-of-life component will handle.
It is likely that Thailand will follow a hybrid approach with separate platforms for product and end-of-life policies. The Thai RoHS is basically a copy of the RoHS Directive in the EU and, thus, has a comprehensive scope. At this moment, there has not been much discussion on this since the standards are only voluntary. Therefore, the rest of the section will dedicate to the Thai WEEE.

The Thai WEEE is likely to have a selective scope, indicating from an erection of a taskforce under the Thai WEEE Committee to prioritise and select products to be regulated. Most of the interviewees also show their approval of such an approach, especially at this early stage of WEEE management in the country, and our interviews quickly turned into the issue of which products should be prioritised and selection criteria.

According to the minutes of the taskforce, there are three sets of selection criteria: technical criteria (T), environmental and social criteria (ES), and economic criteria (EC). Weights are also assigned to individual criterion, as shown in Table 11. In this way, 10 out of the total 27 product groups receive 60 or more points: (in order) CRT TV and monitor sets (78), digital cameras and cam recorders (74), portable media players (70), cordless phones and handheld transceivers (68), LCD and plasma TV and monitor sets (66), fluorescent and other discharging lamps (66)[17], refrigerators and freezers (62), unit-type air conditioners (62), personal computers and notebooks (62), and printers and facsimiles (62). However, due to the limitation of the integration method, the prioritisation exercise fails to reflect clear rationales behind the interventions (see Appendix IV). But it must be noted that the list is tentative and opens for further discussion and improvements.

Table 11 Selection criteria and their weights

Set	Criterion	Description	Weight
T	1	How difficult it is to disassembly, recycle, and disposal of the waste product?	3
	2	Are there proper disassembling and recycling technologies for the waste product in Thailand?	3
	3	How large is the annual sale volume of the product in tonnes per year?	2
ES	1	How long is the average product life?	2
	2	Is there a proper management of the waste product so hazardous substances do not contaminate the environment?	3
EC	1	Does the product contain precious materials?	2
	2	Is there a buy-back offer for the waste product now?	3

Note: Each product is rated against each criterion with a three-point scale. For example, in T3, an annual sale of 10 000 t/y or more would lead to 5 points, between 3 000 and 10 000 t/y to 3 points, and less than 3 000 t/y to 1 point. The points are then multiplied by their respective weights and summed up to the final score. The maximum point is 90.

Source: (Thai WEEE Committee 2008)

5.3 Institutional users and private households

As can be seen from Section 3.2 and 3.3, the different nature between waste from institutional users and from private households can render the end-of-life management of the former easier and more profitable. Thus, it is worth discussing how this advantage at a managerial level should be perceived at a policy level. A more specific policy questions is: Should there be a statutory division between them?

The EU WEEE Directive explicitly makes the division and allows the producers and institutional users to conclude agreements about financing methods to deviate from those stipulated in the Directive. This provision enhances the flexibility of the system to better suit WEEE from this point source. Similarly, EPR programme for PC in Japan set different physical and financial mechanisms between business-to-business (B2B) and business-to-consumer (B2C) products. Nevertheless, such a provision can only come after a careful investigation of the flow of B2B products. If there is an extensive flow of used B2B products to the B2C sector, where those articles would eventually become waste, the provision could turn out to be a way of avoiding producer responsibility (there is not yet a system which classifies B2B users who resell used products as a producer). For example, there will be no guarantee for end-of-

17 In the hearing, there was a proposal to differentiate between tube- and compact-type fluorescent lamps because the two require different treatment methods and their mercury content are different.

life management of these products, thus leading to the problem of orphan products.

There has not been any proposal to make such a division by law in Thailand. Some interviewees asked believed in the difference and suggest exploring it in awareness raising campaign or other targeted actions. Some gave examples where source separation campaigns have gained good cooperation from business establishments and one highlights the role of company's environmental policies. As shown in Section 3.2, for computers, it might be reasonable to target business establishments for this purpose based on a number of employees.

5.4 Definition of producers and their responsibilities

In theory, EPR targets the manufacturers of products placed on the market. Defining "producers" in real supply chains can, however, be much more complex. In many cases, it is not the manufacturer who puts a product on the market. Although the details and wording are different, all EPR laws have a definition of a producer covering manufacturers and importers of products placed on the domestic market for the first time. A final brand on the product is one of the key criteria for identifying the responsible producer. Besides the operational definition, as discussed in Section 2.3, there is also an issue of to which of their responsibilities will be extended by laws and to what extent.

We take the definitions in the PCD's draft Act as a starting point. There, manufacturers and importers were defined as the followings:

> "Manufacturer" means any person who makes, combines, transforms, assembles, modifies, or through other processes produces a product that will generate hazardous waste from used products as specified in the Act;
>
> "Importer" means any person who import or order into the Kingdom a product that will generate hazardous waste from used products as specified in the Act;

A main responsibility of manufacturers and importers stipulated in the PCD's draft Act was the financial one. Article 6 stated that manufacturers and importers had a duty to pay product fees at the rates specified by the ministry with an advice from the fund committee. In addition, manufacturers and importers have information responsibilities as stipulated in Article 55 to (1) put a crossed-out-bin label on the products or packaging and communicate to consumers and to (2) provide information about components and substances in the products to facilitate their end-of-life management.

It has not yet been concluded where to levy the fees. The fees can be collected at the factories' and custom's gates but they can alternatively be collected at the points of sales. In practice, these approaches demand different sets of tax-base data. Within the former, import statistics are believed to be reliable but not domestic production statistics (see Section 3.4). For the latter, the dataset is at most as reliable as Table 6 but it might be possible to investigate a way to use the existing database for VAT. This latter approach would be more compatible to a brand-based definition of producers. To our knowledge, the issues of unaccountable channels and reuse/refurbished products have not been addressed yet.

Regarding their responsibilities, it can be debateable on why should the producers be responsible only for financing the governmental system but not over the administration or physical management of the system. According to informants involving in drafting the PCD's draft Act, local manufacturers showed their preference over this limited responsibilities to, for example, the then competing DIW's scheme (see Section 4.1).

On the other hand, interviewed MNCs in the ICT sector would like to have more control over the physical treatment and recovery activities because, if things would go wrong at this stage, it is likely to be the image of brand owners that gets damaged. Unlike their local counterparts, these companies have gained experiences from their global take-back policies. They are rather sceptical whether the arrangements under the governmental system would be able to live up to their global practices, not to mention that they possess superior knowledge of product characteristics. It is worth noting that, although these MNCs (all with leading market shares in their sector) would be main "producers" in an EPR programme, they have not participated or been consulted over the course of previous law making in Thailand, in contrast to local manufacturers.

5.5 A level playing field between compliance schemes

In the transition period, it is likely that most producers would face uncertainty in which directions to take to comply with the EPR requirements, and would thus tend to pool resources to share the risks. Although a correctly formulated regulation should take this into account, it must not prematurely rule out the possibility of IPR.

Currently, many EU Member States' national legislation has delved deep into how to design their system in a way that accommodates the evolution of a large collective compliance scheme and "penalises" a producer, or a group of producers, who develops competing compliance schemes (van Rossem et al. 2006b). For example, a large collective compliance scheme might be exempted from providing financial guarantees and does not have to prove the financial sufficiency (or sustainability) of the collective system. When

keeping the objectives of EPR in mind, however, the opposite holds true: IPR and CPR should receive at least equal treatment and if one should be favoured, it should be IPR. Herold (2007) finds that national schemes have weakened prior voluntary take-back initiatives because they do not take in account efforts individual producers put into their independent schemes. The same can be said for a centralised governmental scheme.

It is clear that the Thai government is determined to establish a national fund for the management of regulated waste products. Competition at the scheme level thus seems unlikely. Interviews with the authorities reveal that they are not convinced about the benefits of competition between collective compliance schemes, especially when considering complexities in administering such a system. Their reference case is the German system, a champion of the concept of competition, that some of them have paid visits (see Section 3.6). In addition, they do not think that producers in Thailand would form consortia like in Japan. Our informants in the industries support this view. Japan is perceived to be unique with the domination of Japanese brands in the markets and strong corporatism in policy making. Actors are more diverse in Thai markets and some of them only come loosely together under the umbrella of FTI.

However, MNCs with a global take-back policy argue that the national scheme should not discourage producers to come up with their own initiatives, individually and collectively. They also do not find the governmental-fund model attractive at all. Their stereotypical worries are that the fund management might be bureaucratic and obscure and potentially with a lot of cross-subsidies (noting that these producers have limited product portfolios and the recycling of their ICT products is often profitable). They suggest that there should be an opt-out option in the system where a producer or a group of them can stay outside the national scheme if they can provide an equally effective and credible scheme for their own products.

Correspondents in the government do not object to the suggestion in principle[18] but were rather reserved about its operation. Most authorities are sceptical on how to justify the opt-out in practice. Both sides agree that there must be some sorts of performance indicators such as a recovery rate but their perception of what should establish an acceptable level differ greatly. Those in the government do not think a producer should be let opting out, i.e. stop contributing to the national scheme, unless they can recovery most, says 80-90%, of the products they put on the market. They reason that the 10-20% margin should be considered as a bonus already because the uncollected can still end up in the national scheme, which the producer does not finance. MNCs, on the other hand, counter that the idea of complete recovery is unrealistic and are content on a much lower parameter, e.g. 15% or less.

This expectation gap might be bridged taking into account the proposed scope of the Thai WEEE and the fact that not all producers are keen in taking back. It can be imagined that the mandatory scheme will first target large home appliances while other products for which voluntary take-back schemes are available can be left in the industry's hand at the initial phase. The coexistence can then serve as a basis for performance benchmarking. In other words, one criterion for the selection of additional regulated products can be whether the existence of (a) voluntary scheme(s) that is equally effective to the national scheme in place.

This picture fits perfectly with the situation relating mobile phones but not computers. However, information in Section 3.2 and 3.3 together shows that the combined market share of computer producers that claim to offer take-back services in Thailand is only 30% compared to 70% in the case of mobile-phone producers. Thus, while a product approach for the opt-out of the latter might be justifiable, a brand approach for that of the former might be more prudent. In addition, considering that leading computer makers often have direct business connection with large institutional users, reaching the performance benchmark on a brand basis is not infeasible.

5.6 Provisions for non-compliance and reporting obligations

Last but not least, punitive measures must be in place to discourage non-compliance. To be effective, the system also needs to have a working monitoring and enforcement process in place. Reporting obligations can reinforce monitoring and enforcement. At the very least, a working EPR programme needs information on: (1) producers (through registration, for example); (2) the quantity of new products each producer puts on the market; (3) authorised treatment facilities (ATFs) in the system (through authorisation, for example); (4) the quantity of waste which enters the system, and (5) the quantity of waste going to different treatment and recovery channels. The first two points have already been touched upon in Section 5.4 and would not be repeated here. Still, it is important to remember that all this information has to be updated frequently. Many programmes also specify how long the records have to be maintained.

In the PCD's draft Act, provisions for sanctions against non-compliance and reporting obligations were covered rather well. Section 8 outlines administrative fines and criminal punishments (fines and/or imprisonment) for different kinds of non-compliances

18 One even agrees and refers to a case of packaging industries in Thailand that successfully negotiated with the authorities to establish the Thailand Institute of Packaging Management for Sustainable Environment (TIPMSE) and have a voluntary scheme instead of the government enacting a packaging recycling law.

Part 5 continued
Policy Analysis

while Section 7 laid down a civil liability. Furthermore, Article 11 stated that those who did not pay product fees would incur payment of an interest at the rate of 2% per month up to the outstanding amount and the interests would be count as part of the fees, i.e. they went to the Fund. Buy-back centres would also have a duty to report their activities to respective local governments at a provincial level every three months. If this reporting duty was enforced effectively, it could provide a reasonable cross-check with the industrial waste tracking system against undesirable leakages. There is a proposal to use electronic form (e-Form) for such tracking (Thai WEEE Committee 2008)

The roles of local governments in the system are, however, rather awkward. They are both providers and regulators of buy-back services and the two roles can come into conflicts. For example, on the one hand, private buy-back centres are deemed necessary in increasing the coverage of a buy-back network in a province; on the other hand, they can be perceived as competitors for subsidies to local government's own centres. Another question is how strict the local governments would be to their own operations.

Last but not least, as Section 3.4 shows, it is utmost imperative that these legal provisions would be backed up with strong enforcement. A way to stepping up the capacity in the governmental-fund model is to explicitly include inspection and audit as integral activities in the system. For example, the Taiwanese system, to address the problem of forgery and fraud experienced in its first implementing phase, has put into place and financed a third-party auditing system by the Resource Recycling Management Fund, i.e. by product fees (Manomaivibool 2008a).

image Soi Suea Yai community, Bangkok—Scavenger is giving cash to waste dealer at recycling yard where dismantling is taking place

Part 6
Conclusions

WEEE has become a policy problem in Thailand. Prompted by policy developments elsewhere, Thai policy makers and other stakeholders have looked into the situation in the country and learnt that although the amount of waste has continued to increase together with the consumption, the country is not equipped with a proper management system. This can lead to negative consequences in terms of pollutions and potential health impacts, a loss of resources, and even distortions in international trades. Several authorities have been working to address the problem, recently, under the framework of the Thai WEEE Strategy. The process of drafting the so-called Thai WEEE legislation is also on its way.

The Thai policies seem to follow an international trend to extend the responsibilities of producers in the management of WEEE. According to the EPR principle, engaging producers in the end-of-life management of their products has the potential not only to ensure the management of WEEE in an environmentally sound manner, but also to address the root cause of the problem, i.e. the design of products and product systems.

This report provides a reality check for the prospect of EPR in the Thai context. Principally, we find that electrical and electronic industries and the product markets are rather well organised in the country with only few deviant cases, e.g. mobile-phone batteries. There are also measures to safeguard the borders from illegal imports of used products and WEEE. Therefore, the two main challenges identified in our previous work (Lindhqvist et al. 2008; Manomaivibool et al. 2007), identification of producers and illegal imports, present themselves to a much lesser extent in Thailand.

Collection of WEEE remains a major challenge. But it can be overcome, if the capacities of existing actors, e.g. retailers, repairing shops, waste dealers, and charity organisations, can be mustered and integrated into the system. The integration is feasible considering the fact that the Thai waste-dealer sector has independently shown a sign towards more transformation and formalisation. It can further be facilitated with additional resources mobilised under an EPR programme. A conclusion of the Thai WEEE programme will also give a clear direction for investments to fill the gaps in the recycling sector. Moreover, owing to a global movement, some multinational producers have begun to engage in physical take-back of their products voluntarily. The Thai WEEE should reinforce this momentum.

However, the Thai WEEE as proposed in the draft act proposed by Pollution Control Department and later integrated into the one proposed by Fiscal Policy Office do diverge from being a fully-fledged EPR programme. There, the producers would have to pay product fees earmarked in the governmental fund for the management of WEEE. However, they will have no control over the management of the fund or buy-back networks, which by law would be under the power of central and local governments, respectively. Although the attractiveness of proposed economic instruments is understandable considering the problems experienced in regulatory regimes in the past, policies should not discourage other innovative solutions. Otherwise, without active involvements of the producers, it might be difficult “to reduce hazardous wastes from EEE at the origin and to encourage environmentally friendly design and production”, as aspired in the Thai WEEE Strategy.

We have proposed a way that the national and producers’ voluntary schemes can synergistically coexist in Section 5.5. But such a proposal needs more reflection from stakeholders taking into consideration the Thai context. In general, an engagement of potent stakeholders such as market leaders, main distributors, and large institutional leaders in the policy-making processes should be encouraged to exchange views and experiences and to establish common understandings. We hope that by provide an analysis of the overall picture this work can contribute to that ends.

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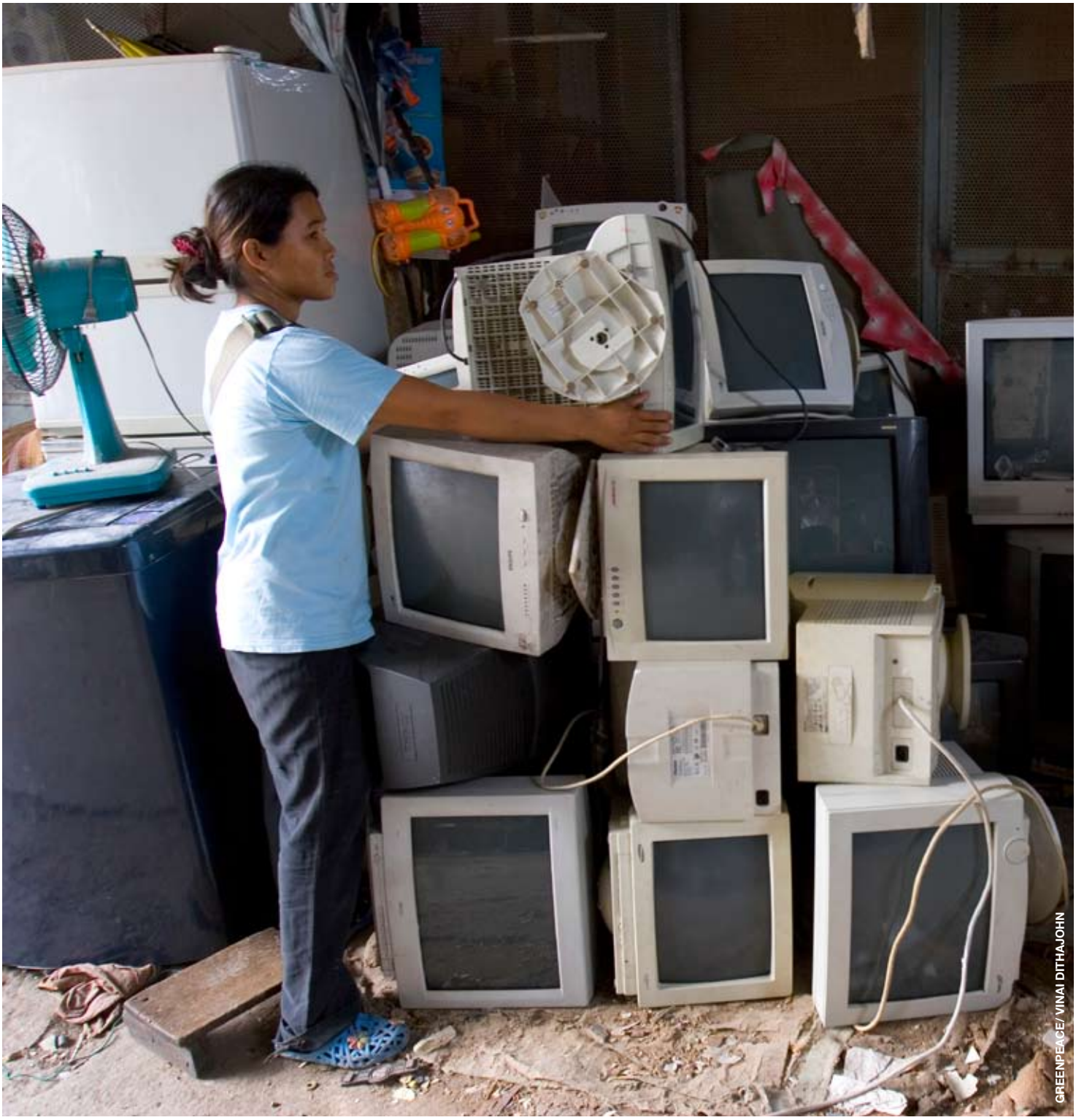

image Soi Suea Yai community, Bangkok - Discarded electrical appliances, TV monitors and computers are being stacked to await dismantling

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appendices

image Soi Suea Yai community, Bangkok - Electrical appliances are being weighed to estimate the buying price before they are crudely dismantled to obtain precious metals, copper and plastic

Appendix 1
Evidence of implementation of individual responsibility[19]

Although individual producer responsibility is often perceived as being harder to implement, whether within collective systems or for brand-specific or limited brand producer systems, practical implementation of EPR programmes around the world has successfully embedded various elements of individual responsibility. In this section, the various patterns identified are presented and categorised based on: 1) when and how the discarded products are distinguished from the rest, and 2) how the producers involve themselves in the downstream operation.

Distinction when collecting from end-users

Table A summarises cases where the brands of the products are already distinguished when products are collected from/handed in by consumers.

This is the case when the users of many of the products are businesses, but measures also exist to collect products of specific brands from households. Some of the products (large professional EEE, copying machines) have high end-values while others do not. The manner in which products of specific brands are collected varies, with different degrees of involvement by end-users. In general, products are picked up from business-users while the involvement of end-users increases in the case of WEEE from households. The manner of payment by consumers varies, including cost internalisation, flat visible advance disposal fees, individual visible advance disposal fees and end-user pays. Likewise,

Table A Examples of individual responsibility (1): brand name distinction at end-users

Products (countries)	The manner of collection and distinction	Arrangement with recovery facilities	Manner of payment by consumers
Copying machines (JP)	Taken back by the producer or a service company	Recovered in the company's own facility	Cost internalisation
Computers used in offices (NL,CH, JP), large professional EEE (SE)	Taken back by the producer/ contracted party	Producers make direct contracts with recyclers. In the case of CH, recyclers must have licence from the PRO	Internalised in the price of new products (NL, SE), flat visible advance disposal fees (CH), end-user pays (JP)
ICT equipment (SE, NO)	Taken back from offices by an intermediary company Establishment of separate collection points for households by an intermediary company	An intermediary company takes care of recovery at the request of the producers	Cost internalisation
Computers from households (JP)	Sent back to the producer via postal service	Recovered in the company's own facility	Historical products: end-user pays, new products: individual visible advance disposal fee
Cars (SE, sold after 1998)	End-users bring the cars to dismantlers contracted by the respective producers	Producers make direct contracts with recyclers. An insurance company has contracts with recyclers for some importers	Internalised in the price of new products
Large home appliances (JP)	Collection by retailers. End-users purchase recycling tickets issued by the respective brands	Recovered in the company's own facility, or producers make direct contract with other producers and recyclers	End-user pays
Batteries for business users (NL)	Collected from end-users at specific dealers	The Producer makes direct contracts with a recycler	Cost internalisation For large quantity, end-user pays

* CH = Switzerland, JP = Japan, NL = the Netherlands, NO = Norway, SE = Sweden

19 Appendix I is excerpted from Tojo (2004, 265-70).

individual manufacturers have varying degrees of involvement in the organisation of the collection and recovery operation. Some domestic manufacturers establish their own recovery plants, while others have contracts with recyclers. As well as the arrangement with the recovery facilities, collection from end-users is organised either by the producers themselves, or out-sourced to a third party. However, what is common is that all the producers have control over the management of their products.

Distinction at intermediary collection points

The products can also be sorted by brand once they are collected from consumers and aggregated at intermediary collection points. Intermediary collection points include retailers, regional aggregation stations, municipal collection points, collection facilities of actors contracted by producers, and the like. Examples are summarised in Table B.
Despite the rather negative perception of some of the interviewees who run collective systems, sorting at intermediary collection points has been operated in various ways. One solution is the establishment of separate collection points by a group of companies who wish to have a separate system, as found in the case of ICT equipment manufacturers in Sweden and Norway, and manufacturers of large home appliances in Japan. This enables companies to enjoy economies of scale with regard to transport and management of collection points, while giving them greater potential to control their

Table B Examples of individual physical and financial responsibility (2): brand name distinction at intermediary collection points

Products (countries)	The manner of distinction	Arrangement with recovery facilities	Manner of payment by consumers
Coffee machines (CH)	Separated from the rest of WEEE by retailers, arranged by the PRO	Recovered in the company's own facility	Flat visible advance disposal fees
ICT equipment (SE, NO)	Sorting at the separate collection points by an intermediary company upon request	An intermediary company takes care of recovery at the request of the producers	Cost internalisation
Large home appliances (JP)	Retailers, municipalities and designated legal entities bring the discarded products into two regional aggregation stations depending on the brands	Recovered in the company's own facility or producers make direct contract with other producers and recyclers	End-user pays

* CH = Switzerland, JP = Japan, NO = Norway, SE = Sweden

Table C Examples of individual physical and financial responsibility (3): brand name distinction at recovery facilities

Products (countries)	The manner of distinction	Arrangement with recovery facilities	Manner of payment by consumers
ICT equipment (NL until the end of 2002)	The brand names and the weight of the respective products were recorded	PRO makes the overall arrangement. The recycling facility sent an invoice to the respective producers in accordance with the total amount of discarded products recycled	Cost internalisation
Large home appliances (JP)	The manifest attached to each product distinguishes the brand name and the model of the respective products	Recovered in the company's own facility or producers make direct contract with other producers and recyclers	End-user pays
ICT equipment (CH)	Periodic samplings take place to find out the average amount of products taken back manufactured by the respective brands	PRO makes the overall arrangement. Producers pay the PRO in proportion to the amount of their products	Visible flat advance disposal fee

* CH = Switzerland, JP = Japan, NL = the Netherlands

Appendix I

own products. Meanwhile, special arrangements can be made with retailers. As found in the case where the brands of discarded products are distinguished when collected from end-users, the degree of involvement of individual producers in organising the collection and recovery operation varies. Often the operation is outsourced to third parties. However, producers have control over the fate of their products. The manner of payment by consumers differs from one case to another.

Distinction at recovery facilities

Table C summarises cases where the brand names of discarded products collected and transported together to recovery facilities, are distinguished at the plants.

In the examples, the physical management of products is performed collectively, at least under the current operation, and all discarded products go through the same recovery process. However, the brand names – and in the case of Japanese manufacturers the models of the products as well – are distinguished before the recovery operation. The involvement of producers in collection and recovery activities decreases, especially in the case of the ICT producers in the Netherlands and Switzerland. However, they have a mechanism for identifying and recording the products that reach the recovery plants.

In the systems presented, the degree of design for end-of-life has not been reflected in the amount paid by the producers, but they illustrate the possibility of distinguishing between the brands and models of products at recycling facilities.

Appendix II
Treatment Standards in the EU WEEE Directive[20]

Selective treatment for materials and components of waste electrical and electronic equipment with Article 6(1)

1. As a minimum, the following substances, preparations and components have to be removed from any separately collected WEEE:

- polychlorinated biphenyls (PCB) containing capacitors in accordance with Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT)(1),
- mercury containing components, such as switches or backlighting lamps,
- batteries,
- printed circuit boards of mobile phones generally, and of other devices if the surface of the printed circuit board is greater than 10 square centimetres,
- toner cartridges, liquid and pasty, as well as colour toner,
- plastic containing brominated flame retardants,
- asbestos waste and components which contain asbestos,
- cathode ray tubes,
- chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC) or hydrofluorocarbons (HFC), hydrocarbons (HC),
- gas discharge lamps,
- liquid crystal displays (together with their casing where appropriate) of a surface greater than 100 square centimetres and all those back-lighted with gas discharge lamps,
- external electric cables,
- components containing refractory ceramic fibres as described in Commission Directive 97/69/EC of 5 December 1997 adapting to technical progress Council Directive 67/548/EEC relating to the classification, packaging and labelling of dangerous substances(2),
- components containing radioactive substances with the exception of components that are below the exemption thresholds set in Article 3 of and Annex I to Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation(3),
- electrolyte capacitors containing substances of concern (height 25 mm, diameter 25 mm or proportionately similar volume)

These substances, preparations and components shall be disposed of or recovered in compliance with Article 4 of Council Directive 75/442/EEC.

2. The following components of WEEE that is separately collected have to be treated as indicated:

- cathode ray tubes: The fluorescent coating has to be removed,
- equipment containing gases that are ozone depleting or have a global warming potential (GWP) above 15, such as those contained in foams and refrigeration circuits: the gases must be properly extracted and properly treated. Ozone-depleting gases must be treated in accordance with Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer(4).
- gas discharge lamps: The mercury shall be removed.

3. Taking into account environmental considerations and the desirability of re-use and recycling, paragraphs 1 and 2 shall be applied in such a way that environmentally-sound re-use and recycling of components or whole appliances is not hindered. …

Technical requirements in accordance with Article 6(3)

1. Sites for storage (including temporary storage) of WEEE prior to their treatment (without prejudice to the requirements of Council Directive 1999/31/EC):

- impermeable surfaces for appropriate areas with the provision of spillage collection facilities and, where appropriate, decanters and cleanser-degreasers,
- weatherproof covering for appropriate areas.

2. Sites for treatment of WEEE:

- balances to measure the weight of the treated waste,
- impermeable surfaces and waterproof covering for appropriate areas with the provision of spillage collection facilities and, where appropriate, decanters and cleanser-degreasers,
- appropriate storage for disassembled spare parts,
- appropriate containers for storage of batteries, PCBs/PCTs containing capacitors and other hazardous waste such as radioactive waste,
- equipment for the treatment of water in compliance with health and environmental regulations.

20 Derived from Annex II and III of the EU WEEE Directive.

Appendix III A Cross Country Comparison

	Thailand	The European Union*	Switzerland	Maine, the United States
Legal framework	Draft Promotion of the Management of Hazardous Waste from Used Products Act (PCD's draft Law) Draft Economic Instruments for Environmental Management Act (DIW's draft Law)	Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (EU WEEE) (2002)**	Ordinance on the Return, the Taking Back and the Disposal of Electrical and Electronic Appliances (ORDEA) (1998)	An Act to Protect Public Health and the Environment by Providing for a System of Shared Responsibility for the Safe Collection and Recycling of Electronic Waste (2004)
RoHS-like product standards	TISI standards (Thai RoHS) (voluntary standards, 2008)	Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EU RoHS) (2002, in effect July 2006)	Ordinance on Reduction of Risk in the Management of Specific Particularly Hazardous Substances (2005, in effect May 18)	An Act to Reduce Contamination of Breast Milk and the Environment from the Release of Brominated Chemicals in Consumer Products (2004, in effect January 2006; only for brominated flame retardants)
Scope	n.a.	EU WEEE: all electrical and electronic equipment which is grouped into 10 product categories*** EU RoHS: 8 product categories of the EU WEEE and electric light bulbs and luminaries in households***	Electrically powered consumer electronics equipment; office, information and communication technology equipment; household appliances; lighting fixtures; lamps (excepting incandescent lamps); tools (excepting large-scale stationary industrial tools); sports and leisure appliances; and toys (as well as components of these)	Computer central processing units and video display devices
PRO	n.a. (PCD's draft Act: a governmental special fund)	At least one per Member State	SWICO (brown goods) and SENS (white goods)	Mainly an IPR programme allowing for collective solutions
Provision for separate collection	n.a.	Yes	Yes	Yes
Separation of new from historical products	n.a.	Yes, 13 August 2005	No	No, but having a brand-based programme and requiring identifying labels on all products put on the market after 1 January 2005
Physical collection	Informal sector (PCD's draft Act: local governments and partners)	Varies among MS but mainly municipalities and retailers	Dedicated collection points, retailers and manufactures/ importers	Municipality
Financial mechanism	n.a. (DIW's draft Act: product fees)	Collective on the market share for historical waste, individual through financial guarantee for waste from new products The transposition did deviate, however; some Member States allow producers to use 'visible fees'	Collective on market share through the recycling fee on new appliances	Consolidation facilities charge producers recycling costs individually; costs of orphan products shared among producers on a pro rata share
Recovery & Recycling targets	n.a.	Yes	No	No
Authorisation & treatment standards	Yes	Yes	Yes	Yes
Monitoring & enforcement	Pollution Control Department (PCD) and the Department of Industrial Works (DIW)	Depending on the Member States, mostly environmental or trade authority	National and cantonal authorities, Technical control bodies of PROs	Bureau of Remediation & Waste Management, the Department of Environmental Protection, the State of Maine

* The EU now has 27 Member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom. Here only the EU-wide policy frameworks, the EU WEEE and RoHS Directives, are referred to. The transposition of the two directives in the EU Member States does vary, however (see Huisman, Stvels, Marinelli, and Magalini 2006; IPTS 2006; van Rossem, Tojo, and Lindhqvist 2006; Mayers 2005).

** In practice, the effective date of the EU WEEE Directive depends on the EU Member States' transposition which was due on 13 August 2004. However, most Member States could not meet this timeframe.

*** The 10 product categories are: (1) large household appliances, (2) small household appliances, (3) IT and telecommunications equipment, (4) consumer equipment, (5) lighting equipment, (6) electrical and electronic tools (with the exception of large-scale stationary industrial tools), toys, leisure and sports equipment, (8) medical devices (with the exception of all implanted and infected products), (9) monitoring and control instruments, and (10) automatic dispensers. The two categories not covered in the EU RoHS Directive are (8) and (9).

	Japan	China	South Korea	Taiwan
Legal framework	Specific Household Appliances Recycling Law (SHARL) (1998, in effect 2001) Law on the Promotion of Effective Utilization of Resources (Japan Law) (the 2000 amendments)	Ordinance on the Administration of the Recovery and Disposal of Waste Electronic and Electrical Products (China WEEE) (2009, in effect 2011)	Act on the Promotion of Saving and Recycling of Resources (the 2003 amendments) MoE's draft Act for Resources Recycling of Electrical/Electronic Products and Automobiles (first to the WTO 2006, expect to be effective 2008)	Waste Disposal Act and relating regulations (the 1998 amendments)
RoHS-like product standards	A part of the Enforcement Order of the Law on the Promotion of Effective Utilization of Resources (Japan RoHS) (the 2006 amendments)	Measures for Administration of the Pollution Control of Electronic Information Products (China RoHS) (2006, effective March 2007)	MoE's draft Act for Resources Recycling of Electrical/Electronic Products and Automobiles (first to the WTO 2006, expect to be effective 2008)	n.a.
Scope	SHAR Law: TVs, washing machines, refrigerators, air conditioners Japan Law: computers Japan RoHS: TVs, washing machines, refrigerators, air conditioners, computers, microwave ovens, cloth driers	China WEEE: To be announced China RoHS: all electronic information products	TV, washing machines, refrigerators, air conditioners, computers (2003) mobile phones, audio equipment, fax machines, printers, copiers (2004, 2005)	Heaters/air conditioners, refrigerators, TVs, washing machines, computers, fluorescent lamps, printers
PRO	2 Consortia	(China WEEE: a governmental special fund)	MoE performs clearing house allocating annual responsibility Recycling business mutual aid associations	Resource Recycling Management Fund and is managed by the Taiwan EPA
Provision for separate collection	Yes	n.a.	Yes	Yes
Separation of new from historical products	Possible with Japan RoHS's marks, but not on all products	Possible with China RoHS's marks, but not on all products	No	No
Physical collection	Retailers, municipalities, and designed body (Association for Electric Home Appliances)	Informal sector	Retailers and municipalities	Dedicated collection points
Financial mechanism	Collective within a consortium Under SHAR Law, end users buy/pay recycling tickets Cost internalisation for new computers under Japan Law	Fees and recycling subsidies	Individual responsibility allocated on market share	Individual recycling, clearance and disposal fee allocated on market share
Recovery & Recycling targets	Yes	n.a.	Yes	No
Authorisation & treatment standards	Yes	Yes	Yes	Yes
Monitoring & enforcement	The Ministry of Economy, Trade and Industry (METI) Association for Electric Home Appliances	China WEEE: The Ministry of Environmental Protection China RoHS: State Administration of Quality Supervision, Inspection and Quarantine (SAQSIQ)	Ministry of Environment (MoE)	Taiwan Environment Protection Administration (EPA)

Appendix IV
Comments on the Prioritisation of Electrical and Electronic Products in Thailand[21]

This document presents a review of a prioritisation exercise by a group of researchers specialised in product policies at IIIEE, Lund University. It is prepared based on the results of a prioritisation exercise as presented in the documents of the third meeting of the Thai WEEE Committee (Thai WEEE Committee 2008). The exercise was part of the Thai WEEE Strategy. It aimed to select certain types of electrical and electronic equipment for the first phase of the implementation of the "Thai WEEE".

Key findings

We understand that the prioritisation is unavoidably a subjective exercise where different values are weighed on multiple criteria and appreciate the attempt of the taskforce that tried to carry out it in a systematic and structured way. However, we feel that the resulted ranking is rather mixed and does not well reflect clear policy rationales behind the (future) policy interventions. Principally, we trace the causes of such ambiguity to the integration method. We thus discuss this key issue before adding some other minor comments.

Integration method

Our understanding of the prioritisation methodology is that in the final step (weighed) scores of different criteria are added up into a final score for each product groups. This is a simple yet questionable procedure as it is similar to comparing an orange and an apple.

Here, we demonstrate that an alternative procedure can yield different ranking and throw some light on the interpretation of the results. The technique is a factor analysis, though other techniques such as an analytical hierarchy process (AHP) can also be implemented. A factor analysis is a statistical technique that groups variables into (fewer) "factors" based on their interdependencies. We choose the technique because we notice patterns in the prioritisation exercise that scores of certain criteria tend to correlate to each other but not to the others. A factor analysis can also give a new set of (regressed) scores that can use to rank products from the perspective of different factors.

Table A shows the result of the analysis which produces two factors/components. Please note that the criterion "Precious Metals" is excluded after the first run because it does not clearly belong to any of the factors. Such exclusion improves the robust of the result, i.e. the two new factors can explain over 80% of the variances in the scores of the six remaining criteria comparing to an initial (very acceptable) 75%.

We find that the result is not only statistically robust, but seems to also be logical. The first factor is named "physical conditions" because its main contributors are four criteria directly relating to product characteristics: (from their contributions to the factor) ES2 (environmental management systems), T2 (treatment technology), T1 (product complexity), and T3 (shipment volume). In other words, a proper management of complex products to ensure minimal environmental impacts tends to require advanced treatment technologies that do not exist in Thailand under the normal market basis, i.e. the private costs of such a system might outweigh the private benefits. It is interesting that shipment volume belongs to this factor, though its contribution (0.75) is considerably lower than the other threes.

The second factor is named, "socio-economic conditions". Its main two contributors are the criteria EC2 (buy-back), and ES1 (lifetime), which are more influenced by the socio-economic context in the country. The criterion T3 "lifetime" also has a non-negligible contribution to this factor. The minus sign showing an inverse relationship is also logical because the sheer quantity of the supply of certain wastes is one of the key factors a waste dealer considers whether to have a buy-back offer for the wastes. So, T3 and EC2 should and do have an inverse relationship.

Table A

	Component	
	1	2
Complexity	.914	.001
Technology	.939	-.095
Volume	.748	-.345
Lifetime	-.214	.809
Manage	.944	.079
Buyback	.106	.908

Extraction Method: Pricipal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Then, we rank products according to their new regressed scores of the two factors. The new rankings are compared with the original ranking of the prioritisation exercise in Table B. The top 10 product groups in each ranking are coloured in green.

21 This appendix contains comments made by the authors to the Thai WEEE Committee as part of its hearing on prioritisation criteria.

This analysis shows that there are two underlying factors considered in the prioritisation exercise. By keeping these two distinct (i.e. not adding everything up into a single score), we can see two groups of target products. The first is the products rank high under the physical factor. Interestingly, this group of products and their ranking show a similar pattern to the initial selection and gradual inclusion of regulated products in existing WEEE programme with a selective scope abroad (Japan, South Korea, Taiwan, etc.) starting with large household appliances and later expanding to cover ICT products.

The second group consists of more diverse products that sharing a characteristic of being small equipment. Based on international experience, they are rather unorthodox products to start a WEEE management system. Another interesting point is that the products that are not overlapped in the top 10 of the two factors tend to require different end-of-life management systems. For example, operationally in Europe (where all types of WEEE are covered by laws) WEEE is sorted into five treatment fractions: large household appliances (simple shredding processes); cooling appliances (required an additional treatment of ozone depletion substances on the top of shredding); Monitors (mainly CRT for current waste, required disassembly and cleansing of glass; for LCD, required disassembly of mercury backlight); Small household appliances (have a problem in collection into the system); and, Lamps. The issue of treatment requirements will be elaborated in the next section. At this point, one issue is what Thai policy makers think to be important for the start-up of the system: the first factor, the second factor, or both.

Appendix IV

Table B

	RANKING				EC1 score
	Original		Physical factor	Socio-econ factor	
	weights	no weight			
CRT TVs and monitors	1	1	1	12	3
Digital cameras and cam recorders	2	2	5	2	3
Portable media players	3	2	8	4	5
Mobile phones, cordless phones	4	2	10	3	5
Fluorescent and other gas discharging lamps	5	5	7	8	1
LCD or Plasma TVs and monitors	5	5	2	20	3
Personal computers and notebooks	7	5	9	15	5
Printers and faxes	7	5	12	13	5
Refrigerators, freezers, automatic dispensers	7	9	2	20	1
Unit-type air conditioners	7	9	2	20	1
Video games and toys	11	9	15	1	3
Audio sets	12	9	13	16	5
Washing machines	12	13	6	25	1
Copiers	14	14	11	19	3
Scanners	14	14	16	9	3
Alarms	16	16	17	5	1
Calculators	17	16	18	6	3
Ovens and microwaves	18	18	14	23	1
Shavers	19	19	22	7	1
Hair dryers	20	20	23	10	1
Irons	20	20	23	10	1
Fans	22	20	20	17	1
Rice cookers, water boilers, electric pans	22	20	20	17	1
Tools	24	24	19	24	1
Toasters, and waffle makers	25	24	27	14	1
Cloth dryers	26	26	25	26	1
Water boilers (shower)	26	26	25	26	1

Other comments

- The two-scale weighing scheme (a weight of 3 if the criterion is very important and 2 if it is less important) that is used in the priority exercise is not only arbitrary, but also lacks a differentiating power. As can be seen in Table B, the ranking is hardly affected with or without weighing.

- Criteria relating to treatment technologies (T1 and T2) can be viewed from a system planner's perspective. From our interviews, one of the inspirations of the Thai WEEE is to establish a WEEE treatment infrastructure that is today missing. At the same time, there is a common understanding that the system must be gradually evolve over time and we cannot expect to have everything in the beginning. So, if there is a concrete idea of what would be built first, this can be a starting point of the prioritisation. Instead of considering the level of technologies per se, it might be the compatibility with planned infrastructure that really matters.

- What is the exact role of lifetime? We feel that the use of lifetime can in a way be a bit redundant if the volume criterion is presented in terms of annual shipments. One of the reasons why some relative light products such as mobile phones and lamps score quite high on the volume criterion is because of their short-replacement cycles (another is their widely usage, comparing to video consoles). So having both criteria might be double counting. On the other hand, lifetime can be a useful criterion to see when waste will occur, e.g. current, near, or far in the future. But this line of thinking would need a different procedure than that used in the priority exercise. For example, if the focus is on current waste, first, the average time has to be estimated and, then, shipment statistics the past (e.g. shipment volume 10 years ago for refrigerators, 2 years for lamps, etc.) would be filled in the volume score, not the current figures.

- A caution against the use of current shipment volumes. The shipment volume criterion is very useful for a policy regulate the present and the future, e.g. the EuP Directive that regulates new products. When applied to a WEEE policy that also involves the management of the past legacy, it can be misleading. For example, in a near future, an exercise similar to this prioritisation would give a low score in terms of shipment volumes to CRT monitors that were replaced by newer technologies; however, in terms of waste volumes, CRT would be a more pressing problem.

- What are counted as buy back? Within the current scheme, an existence of buy-back offers is viewed positively (score=1). But it is not clear on the definition of buy-back. For example, LCD and plasma monitors are reported to be widely bought back. But we understand that, though they might be bought as a (functional) second-hand monitor, there is almost no market for waste LCD and plasma monitors at this moment. Recyclers in both developed and developing countries we have been in touch are in the opinion that the products do not contain a lot of valuable materials for recycling, not to mention the costs of the treatment of hazardous substances. Even repairers in Thailand complain that once the products are broken it is very difficult to repair these monitors. Thus, we suggest that buy-back should only count for buy-back offers for the recovery value of waste, not for the functional value of second-hand products.

- Buy-back: boon or bane? Another issue relating to buy-back is its merit from a perspective of formalising a WEEE system for environmental protection. Buy-back offers for wastes normally reflect financial benefits of recycling but they do not necessarily ensure that the costs are fully taken into account, especially when it is possible to practice the so-called backyard recycling. Therefore, where buy-back (EC2) exists for complex products (T1) but without proper treatment technologies (T2) and/or management systems (ES2), it might lead to greater environmental impacts (worth a 5 score not a 1) than if there was no buy-back. This is why a mobile phone producer argues that the fact that people normally simply store their obsolete mobile phones might not be that bad (see attached file from the producer), though there is clearly a collection problem in this case.

In Conclusion

We encourage a systematic and rigour prioritisation with a clear focus on the rationales behind the policy interventions. This is indispensable to provide a solid basis for this inherently subjective exercise.

image Soi Suea Yai community, Bangkok - Printed wiring board (PWBs) are dismantled by bare hand before being sold.
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