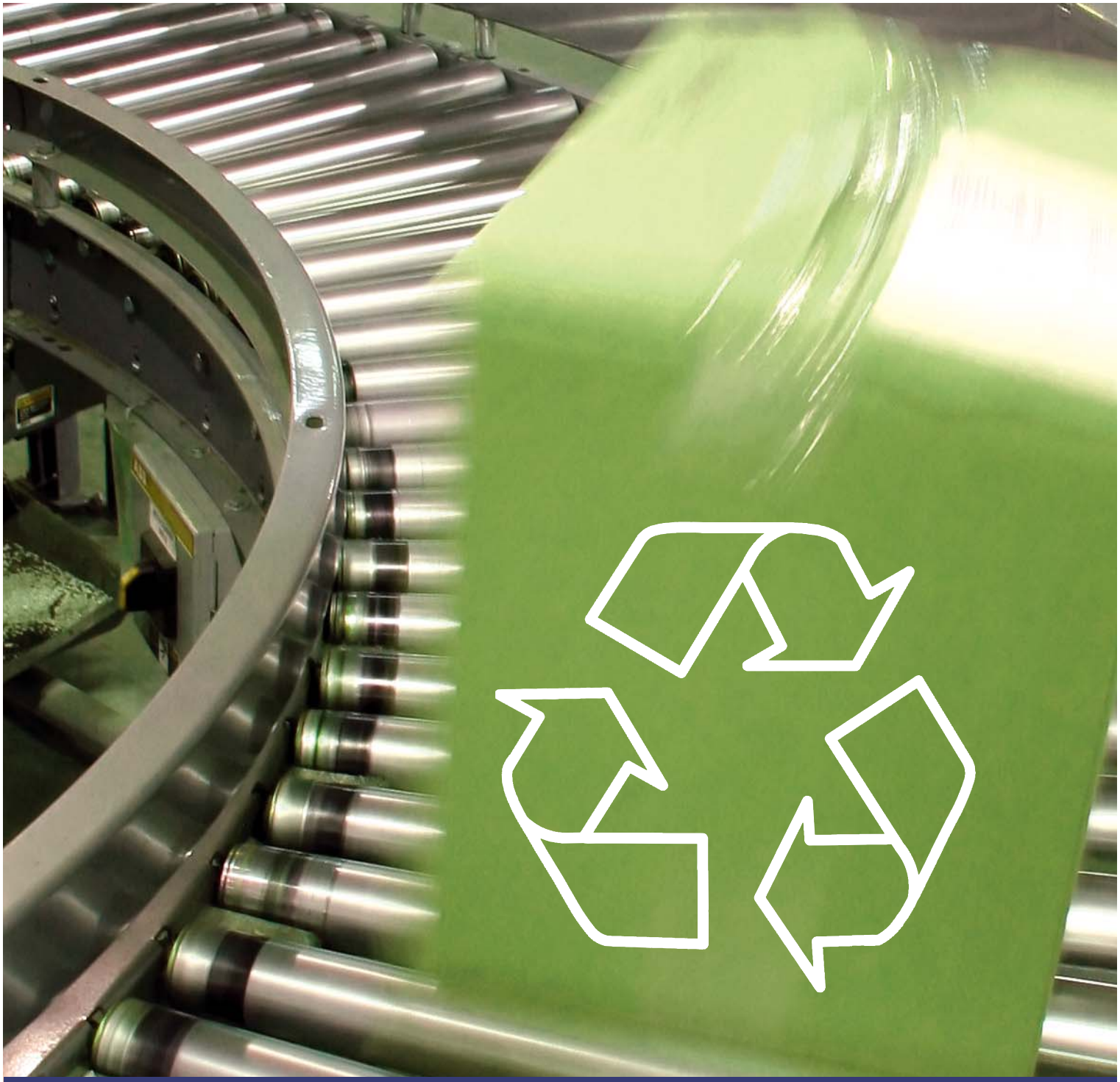

EPR

EXTENDED PRODUCER RESPONSIBILITY

AN EXAMINATION OF ITS IMPACT ON INNOVATION AND GREENING PRODUCTS

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Extended Producer Responsibility

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Report commissioned by Greenpeace International, Friends of the Earth and the European Environmental Bureau (EEB)

Prologue by Greenpeace International, the European Environmental Bureau and Friends of the Earth Europe

The term 'Corporate Social Responsibility' (CSR) is very much in vogue with companies communicating their values and achievements in annual CSR, Corporate Citizenship and Sustainability reports. Organisations and consultancies have been created to rate companies on their corporate responsibility and to advise them on business ethics and the environment, while others, like the Global Reporting Initiative (GRI),develop and disseminate 'Sustainability Reporting Guidelines' for voluntary use by organisations reporting on the economic, environmental, and the social dimensions of their activities, products and services.

Images of electronic waste in the form of discarded computers and other 'electro-scrap' dumped in Asia, other social and labour issues as well as pressure from civil society, prompted the electronics sector to develop an Electronics Industry Code of Conduct. However, despite this Code, the hi-tech sector continues to produce ever shorter-life, often superfluous products with inherently hazardous materials. Why are hi-tech corporations, which profess to be responsible corporate citizens allowing this to happen?

One answer is that CSR initiatives, whether they involve Codes of Conduct or reporting guidelines, are voluntary. At best, CSR can be a way for the best companies to lead the way. At worst, CSR initiatives can even be a diversionary tactic, used by industry to pretend that they are taking action and to avoid regulation.

Extended Producer Responsibility (EPR), the subject of this report, is thus a necessary step, if the industry is to become a more responsible corporate citizen. EPR, as a principle of product policy, was first introduced into law in the early 1990s to address the lifecycle issues of products – especially what happens to them at the end of their life – using a target-oriented approach, instead of traditional command-and-control type regulation. By extending the responsibility of producers beyond the factory gates and creating economic incentives to achieve set targets for collection, re-use and recycling, manufacturers should become more aware of the issues related to the end-of-life management of their products. Rational manufacturers would presumably try to find a way to minimise the costs associated with end-of-life management by changing the design of their products, to reduce those costs.

Greenpeace International, Friends of the Earth Europe and the European Environmental Bureau commissioned this report to examine how far EPR laws in Europe, Japan and elsewhere are delivering improvements in products' environmental performance. This report provides evidence based on existing EPR programmes and anticipated EPR legislation, that EPR laws – both those mandating substance bans and setting re-use/recycling targets – do indeed prompt positive product design change.

In particular, individual producer responsibility policies are shown to be more effective in creating incentives for product design change, than policies requiring collective producer responsibility.

So, governments must ensure that any Producer Responsibility law allows the possibility for producers to take individual financial responsibility for their end-of-life products. This requires true financial guarantees for all 'new/future' discarded products, i.e. products put on the market after entry into force of EPR legislation. Other requirements should be legally-

binding, include bans on using hazardous substances and ambitious targets for collection, re-use and high-quality material recycling – including, importantly, de-pollution requirements.

Legislation requiring producers to take responsibility for their products' full lifecycle may be the clearest way to discern if corporations are 'walking the talk' on their claims of good corporate citizenship. What is more, research in this report shows that those companies which take back their end-of-life products can design cleaner, more resource-efficient products if they are responsible for their own-brand goods.

This report therefore also defines the key elements that can ensure effective EPR laws which prompt product re-design for improved sustainability. We hope that governments, waste and product policy-makers, NGOs and anyone who cares about corporations acting responsibly, will find this report of use in their work.

Acknowledgements

The authors would like to thank Greenpeace International, Friends of the Earth and the European Environmental Bureau for engaging the IIIEE in the topical task of examining the impact of Extended Producer Responsibility (EPR) on innovation and greening of products. It has been very useful to gather the experiences and to review the arguments on whether EPR has delivered on these issues.

Several reviewers have taken the time to read earlier draft versions of the report and their input is much appreciated and has clearly improved the report. We would especially like to thank Kieren Mayers, Sony Computer Entertainment Europe, for useful discussions and insight, which have sharpened the ideas that are presented in this report. The full responsibility for the report remains, however, with the authors.

Executive Summary

This report, commissioned by Greenpeace International, Friends of the Earth and the European Environmental Bureau (EEB), explores the impact of Extended Producer Responsibility (EPR) on innovation and the greening of products. It aims to reiterate the value that EPR has as a policy principle to improve the environmental performance of products and their connected systems and that this can be best achieved when the feedback loop of waste management costs goes directly to the individual producer. The report is structured to provide a background of the emergence and development of EPR since the early 1990s, its actual implementation through a variety of policy instruments (administrative, economic and informative), and its role in addressing waste prevention and management.

Key elements of effective EPR implementation

Generally speaking, effective implementation of EPR should bring the achievement of two main environmentally-related goals: 1) *Design improvements of products* – the EPR system should provide incentives for manufacturers to improve products and systems surrounding the life cycle of products. 2) *High use of product and material quality through effective collection and re-use or recycling* – this goal can be sub-divided into three sub-goals, which are a) effective collection, b) environmentally-sound treatment of collected products and c) high use of products and materials in the form of re-use and recycling.

Among these policy goals, the report focuses on the possibilities for the EPR principle to promote design change of products. A principal reason for allocating responsibility to producers is their capacity to make changes *at source* to reduce the environmental impacts of their product throughout its life cycle. It is essentially the producers that decide the features of the products they manufacture at the design phase of products. Rational manufacturers, when made responsible for end-of-life management of their products financially and/or physically, would presumably try to find a way to minimise the costs associated with end-of-life management by changing the design of their products. The establishment of such feedback loops from the downstream (end-of-life management) to the upstream (design of products) is the core of the EPR principle that distinguishes EPR from a mere take-back system. Assigning responsibility primarily to one actor would also avoid the situation where everyone's responsibility becomes no one's responsibility.

There is both implicit and explicit evidence of the impact of EPR on Product Design

Although it is recognised that determinants of product innovation are likely to come from a variety of push and pull factors including law, consumer preferences, customer requirements, etc, this report has been able to present supporting evidence that the anticipation of EPR law has been central for specific design changes for the products investigated. Tojo (2004) provides empirical evidence that EPR law does provide tangible incentives for environmentally-conscious design in the case of electrical and electronic equipment (EEE) and cars in Japan and Sweden. The analysis of her interviews in 2001 revealed that all manufacturers that were interviewed considered anticipated regulatory requirements posed by EPR law in their product development strategies. Upstream measures in design, both in terms of reduction of hazardous substances and enhancement of source reduction of material use, re-use and recycling, have been undertaken in both industry sectors in Sweden and Japan respectively.

Section 3 of this report provides concrete examples of such upstream changes in product design in anticipation of regulatory requirements posed by EPR law. For example, several Japanese EEE manufacturers have made material substitutions to increase the recyclability of their products. Specifically, NEC, Hitachi, Fujitsu, Matsushita and Sony have replaced

plastic housings with magnesium alloy for TV cabinets and personal computers, owing to the low plastic recycling results. Similarly, efforts have been made to improve the recyclability of products through material unification and standardisation of types and grades of plastics used in products (Matsushita, Sharp, Mitsubishi, Ricoh, and Hitachi). Ease of repair and maintenance have been provided by manufacturers such as Hitachi and Mitsubishi, and several manufacturers have adopted modular designs to facilitate component re-use (NEC, Ricoh, and Fujitsu). The use of lead-free solders was implemented with an advance time plan by many Japanese manufacturers so as to be ahead of European law. Ericsson decided to eliminate the use of beryllium, anticipating future recycling advantages. Automotive manufacturers in Sweden (Volvo, SAAB, and Volvo Trucks) have similarly established lists of substances targeted for phase-out and worked on design for disassembly and design for recycling.

In addition to these findings, evidence from corporate environmental and sustainability reports, as recently as 2005, explicitly mention the influence of both the WEEE (Waste Electrical and Electronic Equipment) and the RoHS (Restriction of Hazardous Substances in EEE) Directives on product design. The global influence of the European RoHS Directive – considered as EPR-based policy in accordance with the definition of EPR in this report – on product design change has been far-reaching. It is illustrated that Japanese electronics manufacturers accelerated their compliance efforts in an attempt to gain market share over European and US rivals.

Improved use and handling of discarded products

For the ELV and WEEE Directives, we see not only an impact on the design of new products. The EPR discussion and subsequent law has also led to considerable improvements in the collection of discarded products, treatment of these products and use of components and materials incorporated in the products. De-pollution in the dismantling stage has seen improvements, as has the general treatment at dismantling and recycling facilities. These improvements concern the development of new techniques, but also better control of existing practices. Recycling levels have increased as a result of the targets set in the Directives. However, there is still room for considerable advances in technologies and in control of dismantling and recycling activities.

Individual-versus-collective Responsibility

Concerning the implementation mechanisms of EPR programmes that incorporate take-back and other requirements related to the downstream operation, a notable distinction could be made with regard to the degree of cooperation among producers in fulfilling their responsibility. This distinction is often referred to as individual-versus-collective responsibility. That is, in essence, if a producer takes responsibility for end-of-life management of their own products (*individual responsibility*) or producers in the same product group together fulfil their responsibility for the end-of-life management of their products regardless of the brand (*collective responsibility*). The significance of this issue, among other things, was manifested, in the lengthy discussions during the development of the EU WEEE Directive.

The distinction touches upon a fundamental question surrounding EPR: how should producers fulfil their responsibility to create incentives for design change? Our research finds that Individual Producer Responsibility (IPR) is a better incentive for design change because the feedback loop to the manufacturer is more efficient in rewarding design change through lower costs at end-of-life. Experience from manufacturers of electrical and

electronic equipment and automobiles in both Japan and Sweden shows that such systems have resulted in design change.

If producers need to take care of discarded products similar to their own irrespective of brand, there are few or no incentives to spend extra resources enhancing their product design to reduce environmental impacts from end-of-life. If responsibilities were distributed among brands without considering the difference of environmental properties of the products, producers who worked harder to reduce environmental impacts from their products would end up subsidising producers who did not make such efforts.

It is possible to implement Individual Responsibility

During transposition of the EU's WEEE Directive, we see that the debate over the preference of individual-versus-collective responsibility with respect to providing incentives to producers to design their products for improved end-of-life processing, although easy to conceptualise, has led to confusion among many actors. It seems that there is a common misunderstanding that individual financial responsibility always implies an individual physical responsibility translating to individual systems for collection and treatment of end-of-life products. This is clearly not the case and there is evidence that individual financial and individual physical responsibility is implemented in some collective systems operating today.

The main idea for pursuing individual responsibility is to provide incentives for producers to strive to enhance the environmental performance of the total life cycle of their products. In light of this objective, and reflecting current practices, the meaning of practical individual responsibility can be expressed as follows: A *producer* bears an *individual financial responsibility* when *he/she pays* for the end-of-life management of *his/her own products*. 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 *control over the fate of their discarded products* with some degree of involvement in the organisation of the downstream operation.

To develop EPR systems that drive design change, it is necessary to understand that only new products can be re-designed. Historical products, that is products that have been put on the market prior to the EPR law, will have to be taken care of, but how the costs are allocated will not directly affect the development of new products. Incentives to change the design of new products come from the possibility of differentiation of fees paid for end-of-life management. The costs of this management will only occur at the time of disposal and can be hard to estimate for complex products such as cars and electrical and electronic equipment. Financial guarantees for future costs are the way to ensure that producers take these costs into account when designing products and product systems. Financial guarantees should not only ensure that there are funds to pay for these end-of-life costs, but also provide flexibility and possibilities for competition on the market, thus allowing market forces to develop efficient solutions.

In addition to these minimum elements of individual responsibility, the current struggle with the transposition of the WEEE Directive and experiences of existing systems for EEE and cars exemplify other key issues that need to be addressed to bring about individual producer responsibility: These issues include: a) identification of all manufacturers and importers and their market shares; and b) distinction between historical and new waste by way of, for instance, marking products/components.

It should be stressed that the distinction of products does not require the physical separate handling of individual producers' products. Existing practice where elements of individual

producer responsibility exist within collective systems, suggests that the distinction of products can be made in various stages of the downstream operation. Timing of product identification includes: (1) the point when the end-user discards products, (2) at product aggregation points and (3) at recovery facilities. All these are currently being practised, which shows the feasibility of practising individual producer responsibility.

Future applications of EPR

Three distinct approaches for considering expanding EPR to more product groups are brought forward in this report. The first two approaches fit into the traditional application of EPR, manifested in take-back and recovery target type programmes, while the third is a more novel application of the EPR principle. The first approach is for a wider uptake of product groups through taking the examples of leading countries that have already developed mandatory EPR programmes for the largest number of product categories, such as Canada and Sweden.

Secondly, given the diverse number of products consumed and disposed of in modern society today, it seems feasible to extend EPR programmes to problematic product groups that have not been targeted before. Furniture, children's toys and construction materials have been among products targeted as potential candidates for EPR programme expansion. Owing to their current design, these product groups will often be difficult to recycle from a material perspective without product redesign to facilitate recycling.

Given the wide definition of the EPR principle as used in this report, the extension of responsibility to producers can be expressed in formats that vary considerably from the traditional applications to date. For example, although it may not be feasible to develop take-back programmes for all products consumed in society, the provision of key information by producers to stakeholders at various life cycle stages including retailers, consumers and end-of-life operators may help to reduce negative environmental impacts. Such information can, for instance, help consumers to make more informed choices of products and assist in the optimal management of products during use and disposal. Additionally, extending producer responsibility to other life cycle phases beyond end-of-life stage may encourage new business approaches that include delivering the products' function rather than the product itself.

Applicability of EPR to non-OECD nations

The wide disparity between wealthier consumers and the poor in non-OECD countries justifies action to ensure the producer and actual consumer, but not the general taxpayer, are responsible for the management of end-of-life products. This makes the introduction of EPR programmes a good policy choice. There are a number of important factors to take into account when considering the applicability of expanding EPR programmes to non-OECD nations.

The inclusion of substance restrictions in products, as considered under the broad definition of the EPR principle, is a highly relevant consideration for any non-OECD nation introducing EPR law. Using the example of electronics, given that material restrictions are in place that are impacting the global electronics sector (namely the RoHS Directive), it would be advisable for any nation implementing EPR law to, as a minimum, enforce the same requirements to avoid becoming a dumping ground for any global excess of components containing these restricted materials. This would also avoid manufacturing equipment that would lock in the use of these restricted materials for a considerable time in the future. Given that a considerable proportion of both EEE manufacturing and re-

use/recycling of WEEE takes place in Asia, the benefits of non-toxic products are realised in both phases of the product life cycle.

What must also be considered is the fact that in many cases, used EEE that is sent from OECD countries may more appropriately be categorised as WEEE, which is considered as hazardous waste under the Basel Convention. Given the Convention's envisaged ban on the export of hazardous waste from OECD to non-OECD countries, the import of WEEE should be banned by non-OECD countries. Imported used EEE which ends its life in non-OECD countries should be adequately addressed in any EPR programme.

Care should be taken that existing recyclers in these countries, often operating with limited access to capital, are given reasonable chances to upgrade their activities and continue to work in the sector when new demands on operations are introduced. Government may have to intervene with both regulation and financing to make possible a smooth transition from today's systems.

The potentially large importation of used products and non-branded new products will clearly need to be addressed to ensure that any EPR programme design is financially sustainable. If the total contribution of end-of-life products from these sources is high, the financial burden would fall on the more recognisable local and international brands. However, the possibility of producers taking individual financial responsibility for their end-of-life products should be provided. Europe has addressed this by requiring a financial guarantee to be provided for all new products put on the market, although there appear to be legal loopholes, which allow for this requirement to be circumvented.

Conclusions

Existing research shows that EPR laws do prompt eco-design changes. The drivers of eco-design are strengthened when there is feedback on the total end-of-life costs to individual producers: namely collection, dismantling, re-use and high-levels of material recycling. Existing EPR programmes for WEEE and ELV show that implementing IPR (individual producer responsibility) is possible.

What is also evident is that for products such as cars and EEE, these changes have to date been more the result of anticipating such regulatory requirements than the actual incentives that are provided when the EPR programme is implemented and in operation. It is worth remembering that most producers during the beginning of EPR discussions viewed EPR as a future demand to manage their own products, that is, what later came to be called 'individual producer responsibility'.

The key lesson from the European WEEE implementation to ensure that IPR can become a reality is the need to level the economic playing-field between various EPR schemes.[1] To do this, the following measures are needed to correct the current distortions which favour collective compliance schemes:

1. True financial guarantees for the costs of future waste
2. Internalising the full costs of end-of-life including collection, which in many countries continues to be subsidised by municipalities

[1] See IIIEE Report "Lost in Transposition – Implementation of Individual Producer Responsibility in the WEEE Directive (2006).

3. Ensuring that the economic signal from treatment and recycling reflects the full costs of high-quality material recycling.

Environmental quality has to be secured through demands of high-quality material recycling and not downcycling, that components and materials are re-used and that the environmental problems are not just exported to countries with insufficient law and even less recycling and waste management infrastructure than in OECD countries.

The application of the EPR principle can be expanded further, both in terms of targeted products and types of instruments used. The use of EPR programmes has been expanded geographically as well. When introducing EPR programmes in non-OECD countries, special consideration should be made of issues such as second-hand and non-brand products, waste disguised as recyclables, existing recyclers and inclusion of substance restrictions.

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1 Introduction to Extended Producer Responsibility (EPR)

1.1 Background to EPR

The term "extended producer responsibility", and its concept as a preventative environmental protection strategy was first used and defined by Lindhqvist in a report for the Swedish Ministry of the Environmental and Natural Resources in 1990 (Lindhqvist and Lidgren, 1990).[2]

The emergence of the concept reflected several general trends in environmental policy-making. These trends are the prioritisation of *preventative* measures over end-of-pipe approaches, enhancement of *life cycle thinking* and a shift from the ''command-and-control" approach to a non-prescriptive, goal-oriented approach. It aims to incorporate *incentive mechanisms* for industries to continuously improve their products and processes.

These three features relate to another fundamental element of the concept: making *producers the primary actor responsible for the entire life cycle of their products*. A principal reason for allocating responsibility to producers is their capacity to make changes *at source* to reduce the environmental impacts of their product throughout its life cycle. It is essentially the producers that decide the features of the products they manufacture at the design phase of the products. Assigning responsibility primarily to one actor would avoid the situation where everyone's responsibility becomes no one's responsibility (Lindhqvist and Lifset, 1997). Moreover, in the policymaking and enforcement process it is practically easier to address producers who are relatively easy to identify than, for example, consumers.

1.2 Context for the report

This report aims to reiterate the value that EPR has as a policy principle to improve the environmental performance of both products and their associated systems. Following a brief introduction to the emergence and development of the concept since the early 1990s, the report presents practical issues related to EPR programme implementation. It also provides empirical evidence where EPR programmes provide tangible influence on producers' design strategies. In Appendix I a short overview is given of the key European Directives embracing EPR, while Appendix II presents EPR initiatives outside the European Union.

This comes at a critical time in European environmental policy discussions over the approaches that are most effective in encouraging the prevention and recycling of waste. In some circles there has been increased pressure to challenge the appropriateness of EPR to achieve these goals, often calling for more material-based targets[3] rather than a product specific perspective.

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[2] Elements of the concept could be identified in some policy instruments that were formulated before or in parallel to the birth of the terminology and its definition. Examples include deposit-refund systems for drink containers in Sweden, some states in the United States, management of packaging waste in Germany and the Netherlands and the like. However, people engaged in the development of these instruments did not perceive EPR as a guiding concept for these policy instruments at that time.

[3] Material-based measures as opposed to product-specific measures include setting European collection and recycling targets for material types in general (eg PET), regardless of source, instead of targeting specific product groups or waste streams (eg, PET packaging). This strategy is meant to provide a more flexible approach to achieving the goal of decreasing the disposal of materials in landfill through general recycling targets for specific materials as opposed to targeting individual products or waste streams containing those materials. What is unclear with the material based approach is who would be delegated as the responsible actor for achieving such targets and the fact that this approach would largely ignore waste prevention incentives directed at producers as a result of product focused strategies.

1.3 EPR as a policy principle

The concept has, until now, primarily been incorporated in measures relating to the end-of-life management of products. Meanwhile, the understanding of what EPR encompasses varies, mainly 1) on its purpose and 2) on life cycle phases of products for which the responsibility of producers are extended. Some understand it as a concept that primarily helps improve the situation surrounding waste management (VROM, 1998; Shiota, 1999). This understanding reflects the application of the concept to date. Others find that the concept has wider purpose and consider it as guiding environmental improvement of products and systems surrounding products throughout their life cycle (Lifset, 1993; Davis, 1998; Lindhqvist, 2000). Some consider that the extension of producers' responsibility under the concept is limited to the post-consumer phase of products' life (Shiota, 1999; OECD, 2001). Others suggest that the extension is not limited to end-of-life management of products, but to various parts of the products' entire life cycle (Davis, 1998; Lindhqvist, 2000).[4]

With wider application of the concept, scholars and policy makers started to position EPR differently within the ladder of governmental policy-making. Rather than one of the policy instruments manifesting itself as a take-back scheme, deposit-refund system and the like, EPR is increasingly recognised as a policy principle underlying a range of preventative environmental policies (Davis, 1994; Lindhqvist, 2000; Kroepelien, 2000; Tojo, 2001; Communication from the Commission COM(2003)301 final; de Tilly, 2004).[5]

In this paper, EPR is understood as:

> *…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 product's life cycle, and especially to the take-back, recovery and final disposal of the product (Lindhqvist, 2000).*

1.4 Types of Responsibilities

The extension of responsibilities to manufacturers varies between EPR programmes, both in terms of *types* of responsibility, and *activities* to be fulfilled within EPR-based policy instruments.

Lindhqvist (1992) categorised the types of responsibilities as liability, economic (financial) responsibility, physical responsibility, informative responsibility and ownership, as found in Figure 1-1. The respective types of responsibility are described as follows (Lindhqvist, 1998).[6]

> ***"Liability** refers to a responsibility for proven environmental damages caused by the product in question. The extent of the liability is determined by law and may embrace different parts of the life-cycle of the product, including usage and final disposal.*
>
> ***Financial responsibility** means that the producer will cover all or part of the costs for eg 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.*

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[4] Detailed description on the development of the concept of EPR and definitions given by different people and organisations can be found in Lindhqvist (2000).

[5] More discussion on the development of EPR concept as a policy principle can be found in Tojo, Lindhqvist and Dalhammar (2006).

[6] For other typologies, see, for example, Lifset (1992), Davis (1999) and OECD (2001). In this report, the term "financial responsibility" is used instead of economic responsibility.

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.*

The manufacturer may also retain the ***ownership*** *of his products throughout their life cycle, and consequently also be linked to the environmental problems of the product.*

Informative responsibility *requires producers to supply information on the environmental properties of the products he is manufacturing".*

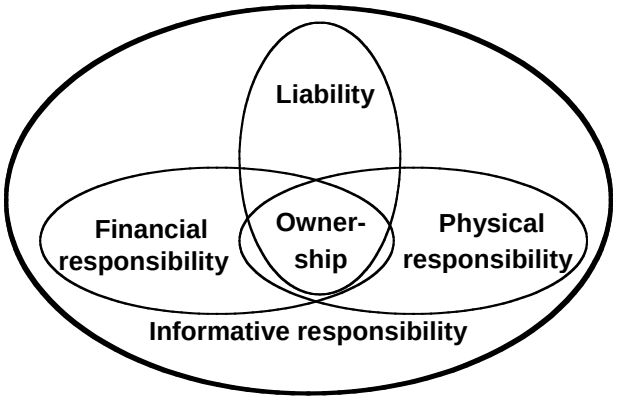

Figure 1-1: Model for Extended Producer Responsibility (Lindhqvist, 1992)

Producers may retain their *ownership* in a product service system (see Footnote 9). As suggested in Lifset (1992), the concept can also take the form of *liability*, such as hazardous waste collection and disposal liabilities and hazardous waste remediation liabilities.

1.5 Multiple Policy Instruments

The EPR principle can be implemented through administrative instruments, economic instruments and informative instruments (Lindhqvist, 1992). Examples of EPR-based policy instruments found in and/or discussed in relation to EPR programmes that extend producers' responsibility to end-of-life management of their products are summarised in Table 1-1. The examples provided are not exhaustive, especially considering the full potential of the application of the EPR principle that has yet to be explored.

Table 1-1: Examples of EPR-based policy instruments

Administrative instruments	Collection and/or take-back of discarded products, substance and landfill restrictions,* achievement of collection, re-use (refill) and recycling targets, fulfilment of environmentally-sound treatment standards, fulfilment of 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.

Source: adopted from Lifset (1992), OECD (2001), Stevens (2004), Walls (2004).

An EPR programme typically consists of more than one EPR-based policy instrument. For example, a manufacturer is given the task of taking back a discarded product that he/she has

produced (*take-back requirement*). This requirement may be combined with an introduction of a *deposit-refund* system to give incentives to consumers to bring back products to an appropriate collection point. A manufacturer may also be required to *label* material composition of components and to provide *information* to recyclers regarding the content and structure of their products. Recyclers must meet certain *treatment standards*. Some of these policy instruments may be incorporated in the revision of existing law governing waste management or the establishment of supplementary law developed in addition to an EPR programme.

In virtually all the EPR programmes, the exact combination of these instruments varies, as evident from a number of studies.[7] However, the widely considered EPR programmes to date include, at minimum, a take-back requirement for post-consumer products.

1.6 The role of the EPR in policy instruments on waste prevention and management

Based on the aforementioned understanding of EPR, the responsibility of producers can be extended to various parts of the products' life. In practice, EPR programmes have to date extended the producer's responsibility to end-of-life management of products, which is often referred to as the "weakest link" for the producers in the product chain (Kroepelien, 2000). In this case, the extension of the manufacturer's responsibility means shifting part, or all, of the responsibility for end-of-life management of products from tax payers, waste management authorities and conventional waste dealers, to manufacturers. This shift may bring multiple, inter-related benefits for society, linking and affecting the various phases of the product's life cycle.

With regard to waste management, an EPR programme helps to reduce the financial and physical burdens upon waste management authorities. They have often suffered from the inadequacy of existing waste management facilities and technologies for dealing with waste streams that are increasing both in terms of volume and variety. The elimination of toxic substances at source, or at least the separation of components using toxic substances from the rest of the waste stream can reduce the risk of health hazards and environmental damage caused by inappropriate waste management. Separation of toxic substances from the rest of the waste stream can also reduce the cost of waste management. Manufacturers' expertise and knowledge about their products can be communicated to waste managers (Lifset, 1993). The involvement of private actors tends to increase the efficiency of waste management practice, such as better logistics for transportation, especially when it is not subsidised. Some view the introduction of an EPR programme as a breakthrough that allows the privatisation of waste management, which had been monopolised by local governments (Tarasti, 1998; Jobin, 1997). Demand for separation and recycling created by the EPR programmes may also induce the development of separation/recycling technology.

If consumers realise that they pay for end-of-life management, they may become more sensitive to throwing away an old product.[8] This may lead to a reduction in waste generation. It may also help create a wider demand and supply for second-hand products or longer-life products. Moreover, it is a way of charging the costs associated with end-of-life management of products to

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[7] See, for example, Rydén (1995), OECD (1996), Davis (1997), Fishbein (1997), Vanthournout (1998), OECD (1998a), OECD (1998b), Tojo (2000), Lindhqvist (2000), Türk (2001), Tojo (2001), Kim (2002), Langrová (2002), Tojo (2003), Tojo et al. (2003) and Tojo & Hansson (2004).

[8] Making consumers pay for their waste has been perceived as one way of providing consumers with incentives to generate less waste. It is manifested in a growing use of "pay-as-you-throw" systems, where consumers pay for waste management depending on the weight and/or size of the waste.

the beneficiaries of the products, instead of leaving the burden to tax payers. This leads to the implementation of the polluter pays principle on products outside production facilities.

The establishment of infrastructure for separate collection and the recovery of discarded products under EPR programmes would not only help improve waste management practice *per se*, but would also enhance possibilities for closing material loops. It also increases opportunities for manufacturers to actually re-obtain the products and/or components for their own re-use and recycling. Sufficient and steady supply of high-quality recycled materials would help create demand for the recycled materials (Lee, 2002; Peck, 2003). Without such infrastructure, manufacturers' efforts towards design for re-usability and recyclability would be in vain.

Further, becoming responsible for the end-of-life management of their products financially and/or physically should force manufacturers to be more aware of the issues related to end-of-life management of their products. Rational manufacturers would presumably try to find a way to minimise the costs associated with end-of-life management by changing the design of their products (both in terms of structure and material use) (Peck, 2003). **The establishment of this feedback loop from the downstream (end-of-life management) to the upstream (design of products) is the core of the EPR principle that distinguishes EPR from a mere take-back system** (Lindhqvist, 2000).

Just as with the establishment of infrastructure, the impact of the design change of products may not be limited to the prevention or reduction of environmental problems related to waste management. Improved design for end-of-life, coupled with infrastructure for separate collection and recovery, would facilitate closing part or all of the material loops. This would provide motivation to lift the value of materials that come to the downstream (Peck, 2003), thus contributing to the improvement of resource efficiency (productivity). A manifestation of the changes of the product system can be found in the shift from selling products to selling the function that a product can provide, referred to as a 'product service system'.[9]

The aim of the environmental improvement mentioned above is the core reason why manufacturers of the final product (original equipment manufacturers: OEMs) are selected as the primary actor responsible. Among the actors in the product chain, it is manufacturers who are regarded as having the highest capacity to prevent problems at source by changing the design of their products/product systems. In almost all the existing EPR programmes importers are assigned the same responsibility as domestic manufacturers to cover both domestically-produced products and imported ones. For the remainder of the report, the term "producers" will include both domestic manufacturers and importers.

A well-designed EPR system focused on end-of-life issues creates incentives for design changes of products, influences the effectiveness of collection of discarded products, the extent to which collected products are treated in an environmentally-sound way, and secures a high use of products, components and materials in the form of re-use and recycling. Lindhqvist and van Rossem (2005) developed an evaluation tool for EPR programmes on behalf of Environment Canada and the Recycling Council of Ontario, which serves as a self-evaluation tool for identifying strengths and weaknesses of existing and planned programmes. Some more information about this approach to evaluating to what degree EPR principles, elements and factors are addressed in a programme is found in Appendix III to this report.

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[9] Further information on the potentials and implementation of product service system can be found in, for example, Mont (2000).

1.7 Individual-versus-collective Responsibility

Concerning the implementation mechanisms of take-back and other requirements related to the downstream operation, a notable distinction could be made with regard to the degree of cooperation among producers in fulfilling their responsibility. This distinction is often referred to as individual-versus-collective responsibility. That is, in essence, if a producer takes responsibility for the end-of-life management of their own products (*individual responsibility*) or producers in the same product group together fulfil their responsibility for the end-of-life management of their products regardless of the brand (*collective responsibility*). The significance of this issue, among other things, was manifested, in the lengthy discussions during the development of the EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment.

The distinction touches upon a fundamental question surrounding EPR: how should producers fulfil their responsibility to create incentives for design change? Industries, government and experts generally assume that an EPR programme based on individual responsibility would promote design change more than one based on collective responsibility.[10] If producers need to take care of discarded products similar to their own irrespective of brand, there are few or no incentives to spend extra resources enhancing their product design to reduce environmental impacts from end-of-life in their new product lines. If responsibilities were distributed among brands without considering the difference of the environmental properties of the products, producers who work harder to reduce environmental impacts from their products would end up subsidising producers who did not make such efforts.

On the other hand, there is also an assumption that the implementation of a programme based on individual responsibility would face more administrative challenges than one based on collective responsibility. For instance, Veerman (2004) suspects that individual implementation would result in duplicated infrastructure for end-of-life management and increased transport. Some recyclers fear that the establishment of recovery facilities by individual producers would threaten the jobs of existing recyclers. Complex, durable products, such as cars and EEE, have features that are assumed to make it difficult for producers to pay in accordance with the environmental impacts their products exert at end-of-life. The lifespan of such products creates uncertainty regarding the actual duration of product use, the development of future recycling technologies and of markets for recycled materials and the like. The number of components and materials used within one product raises the level of uncertainty even more.

The perceptions of these administrative difficulties have raised scepticism in the feasibility of individual implementation in practice, despite the general acknowledgement of the superiority of individual responsibility in theory with regard to promoting design change (Veerman, 2002, December 11, personal interview; Lindsay, 2002, December 11, personal interview). Discussion of the issue is complicated by the lack of clarity over what individual responsibility means in practice. This report will show that individual responsibility is indeed a feasible alternative and that the perceived problems related to such implementation can be overcome.

[10] See, for example, ENDS (2001, May 11), ENDS (2002, February 15), Joint Press Statement (2002), Ferrigno (2003), Lindhqvist and Lifset (2003) and Electrolux (2004).

2 Requirements for EPR to drive design change

This chapter introduces the fundamental requirements on an EPR system that has the properties to drive design change. These requirements constitute various elements of individual producer responsibility (IPR) and include the distinction between historical and new products, cost differentiation, guarantees for future waste management costs and provisions ensuring the possibility for producers to select end-of-life management options (Sections 2.1 to 2.4). An overarching condition these requirements aim to fulfil is the provision of a level playing-field (Section 2.5). Sections 2.6 to 2.8 exemplify the application of IPR under the Swedish ELV system, initiatives taken by individual manufacturers of EEE and in some of the collectively-organised systems for different products.

2.1 Only new products can be re-designed

Allocating *individual financial responsibility* to producers for historical products – products that were put on the market before an EPR programme – is limited from the viewpoint of design change, as the design cannot be altered retroactively.[11] In principle, historical products can be financed in any manner suitable for the respective society. However, the *physical involvement of the producers* would provide them with learning opportunities with regard to design for end-of-life.

During a transition phase, a system based on individual responsibility requires consideration of the treatment of historical products. When it comes to the WEEE Directive, it stipulates that historical products must be financed by a fee based on products put on the market in the same period, that is, a fee on new products. Hence, the decision on how to finance historical products has already been made. As producers of new products are also obliged to finance their own future end-of-life costs, there will be a transition period when producers of all new products are paying into two systems. The Swedish system for end-of-life vehicles is a good illustration of how the two systems can be run in parallel, as described further in Section 2.6.

2.2 Provision of incentives through differentiation

In terms of EPR programmes providing incentives to producers to design products for improved environmental performance from a life cycle perspective with a specific focus on end-of-life, the arguments are fairly straightforward – that is if a producer is financially responsible for his own products at end-of-life, then he/she will be rational and design products to minimise this cost. Of course, not all producers would consider this cost as a decisive factor influencing design (especially weighing all design factors). However, many have anticipated this cost to be significant and in the 1990s had already changed product design accordingly.[12] When we consider substance restrictions as falling under the umbrella of EPR, design change implications are even more evident, especially in global market product groups such as electronics**.** It is crucial that to maintain this trend, EPR programmes are designed so that the efforts of these producers have at least the possibility of being acknowledged in terms of *differentiated end-of-life costs* when and where they are realised.

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[11] Individual responsibility for historical products will also create problems, as it does not provide adequate financing for orphan products, whose producers are no longer on the market. It could also put producers with high market shares in the past in a difficult situation.

[12] This view was met on many occasions by Tojo (2004) when interviewing manufacturers, and has also been experienced by the other authors of this report when talking to company representatives during the period when the directives were discussed and developed. The impression from these interviews and conversations is that all manufacturers were expecting what we today call individual responsibility.

It is also essential that there are incentives to stimulate design changes not only of the products as such, but also of the whole product system. For instance, the end-of-life impacts of a product depends on the collection system and the sorting, treatment and recycling systems. System changes, maybe leading to new business concepts, have potentially the largest opportunities for radical improvements. Also the treatment requirements should be formulated and implemented in a way that provides incentives for producers to strive for real environmental improvements.

2.3 Guarantee for future waste

We cannot assume that all manufacturers will be on the market and able to pay the costs when their products are discarded and treated. Some will have left the market and it will be impossible at this point to enforce a legal requirement for covering costs. A system based on individual producer responsibility necessitates a supplementary system to handle the ''orphaned" products: products whose producers cease to operate in the market. To release producers remaining in the market from covering the cost for orphaned products, a guarantee is needed. This guarantee should be set up when the products are put on the market. We define a true financial guarantee as: *each producer should, when placing products on the market, provide a financial guarantee to prevent costs for the management of orphan products targeted by EPR programmes from falling on society or the remaining producers.*

A ''pay-as-you-go" system[13] (PAYG) is the opposite of a system with true guarantees. Under the pay-as-you go system, when products are put on the market, the producer pays not for the products' future end-of-life costs, but the products that have been collected in the same year. This does not lead to a reward for design change and hence does not drive development of better products.

2.4 Choice of end-of-life management and treatment options

Most businesses outsource a substantial part of their activities and use suppliers to provide them with various materials, components and services. This holds true for end-of-life management. Given that producers are presumably rational economic actors, it is unlikely that they will directly provide the capital to finance new collection or recycling infrastructure, if existing economic actors, which could be contracted for this service, are available on the market. A producer assuming individual producer responsibility must be able to do the same as long as the fundamental requirements of the EPR system are fulfilled. An essential condition for a viable design-change-promoting EPR system is that it provides room for various solutions to be adopted.

One option for a producer is to buy some services from what we call a "collectively-organised compliance system". However, in these cases it is important that participation in the collective system makes the producer fulfil the same obligation as any other solution. Only with this last requirement will we create conditions for real competition between solutions and thus innovation on product design and design of systems for collecting and treating discarded products.

We see that the dualistic nature of collectively-versus-individual responsibility in the debate is often falsely positioned. It is clear that it is, and has been, possible to implement individual producer responsibility within collectively-organised industry-run compliance schemes for a

[13] We define the PAYG financial model as a mechanism to allocate costs of WEEE management to producers proportionately to their market share when those costs occur. The definition includes systems that charge producers a flat fee when placing a product on the market, which is usually based on an estimate of the number of products that are expected to be sold and the amount of WEEE expected to be returned in a given reporting period (usually annually).

variety of EEE product groups (See Section 2.8). Therefore this phenomenon may be better described as a continuum of different individual and collective approaches. It is possible to have both completely collective and completely brand-specific or limited brand systems for compliance at the extremes of the continuum, and hybrid type systems which are designed to include the strengths of both systems (ie collectively-organised compliance systems with individual financial responsibility), all operating simultaneously.

2.5 Level playing-field and flexibility

An overarching condition for enabling EPR that promotes design change to be implemented is the provision of a level playing-field. Competition is a fundamental prerequisite for efficiency. It means that it must be possible for new actors to enter the market and to compete on equal terms. A well-designed system will ensure that no unnecessary barriers hinder such entrances. This means that it must be possible for alternative collection, treatment and recycling systems to be established. It also means that it must be possible for producers to select the way they want to exercise their producer responsibilities: by establishing own systems and partly or fully using the services of other organisations, provided they guarantee the required occupational health and safety and environmental standards.

For economic efficiency, it is essential that a producer can leave a system and join a new system or establish his own system. This will force the various actors to improve their systems continuously. This is equally important when it comes to the system of financial guarantees. A producer must be able to shift the way of organising the financial guarantee without jeopardising the guarantee for the products that have already been put on the market and without jeopardising the guarantees of an organisation he/she belonged to earlier.

To have a level playing-field and a system with competition to secure efficiency, it is necessary that all accepted ways of fulfilling producer responsibility face the same requirements to fully cover the costs of the end-of-life phase and provide a guarantee for these costs that allows a dynamic development on the market.

2.6 Swedish ELV system: collective for old, individual for new

The Swedish implementation of the ELV Directive is a good example of implementing individual responsibility for new products, while at the same time using a common infrastructure – in this case, building on the existing car-scrapping and recycling industry.

In Sweden, a deposit-refund-like system for cars was introduced in 1975 to deal with the problems of fly-tipping of cars and scrappers' improper treatment of materials such as engine fluids. The system has been successful in reducing the problem of fly-tipping, and in improving scrapping by providing scrappers with economic compensation for ensuring environmentally-appropriate treatment (Lindhqvist, 2001). However, the scheme was criticised for not providing incentives to car manufacturers to incorporate consideration for end-of-life management of their cars at the design phase (Lindhqvist, 2001).

In 1997, an EPR system – the Ordinance on Producer Responsibility for Cars – was introduced via law as a replacement for the conventional deposit-refund system. It makes manufacturers and importers of cars responsible for accepting end-of-life vehicles free of charge if the cars were first registered after 31 December 1997 (Article 2). Cars that were put on the market before then would continue to be covered by flat charges on new cars. Manufacturers and importers also became responsible for the establishment of a system that took care of end-of-life vehicles, regardless of their age (Article 3). A re-use and recycling target of 85% to be achieved by 2002

was set, which will be extended to 95% from 2012 (Article 7). In December 2000, the Ordinance was amended to incorporate parts of the then newly-agreed EU Directive (Lindhqvist, 2001).

Consequently, today there are two financial systems: one manages cars registered before 1 January 1998 (historical products) and a second working with "new" cars. The first is a collective system paid for by fees on new cars when they are first registered. The second system is also financed by new cars, but the money is earmarked for future use, that is, a financial guarantee for future recycling costs has been created. The fact that the law allows funding inside the company, through liabilities in the balance sheet, might make the system vulnerable if companies left the market. This is mainly because of the potential difficulties of ensuring that in the event of a bankruptcy, creditors would not be able to seize these earmarked funds. Hence, the system lacks a safe guarantee.

2.7 Individual manufacturer initiatives for WEEE management

There are a number of ICT and large home appliance manufacturers that sell products both in the consumer and business-to-business markets that have developed individual systems to recover their own branded products and competitors' products (on old-for-new or in trade-in and upgrade offers). Although more common for commercial customers, there are increasing examples where manufacturers are promoting take-back of their own products, or competitors', in the consumer market as well.

Business-to-business (B2B)

Probably the best-known example of B2B individual take-back is **Xerox Corporation's** business leasing model and the subsequent closed-loop supply chain model it has developed. Since 1991, Xerox has built up a comprehensive design for environment programme that explicitly considers the logistics necessary for its product take-back and asset recovery programme. With respect to its take-back activities, Xerox-Europe estimates that for all products it sells or leases (photo copiers, printers and supplies) the return rate is over 65%. (Guide, 2001) Many, if not all, products returned are either repaired or re-manufactured at least once, and may subsequently either supply spare parts for repair services or be fed into manufacturing of new products, ''re-manufacturing". The ultimate fate of these products or components includes material and thermal recycling (ie incineration with energy recovery), and some disposal. Although Xerox pioneered this business model, today nearly 80% of all photocopiers are marketed through the leasing model.

Owing to their sales relationships with business customers and the costs involved in disposing of unwanted equipment for commercial clients (prior to WEEE Directive), certain producers are offering product take-back services at the time of new sales. A number of global ICT equipment producer websites offer product take-back & trade-in services which seem to be targeted to easing the process of acquiring new equipment and minimising cost and/or maximising revenues for equipment with residual value. Examples include IBM, Dell Computer and Hewlett Packard (HP). B2B contracts providing for take-back and provision of new EEE may also enhance brand loyalty.

These offers are often bundled with other value-added services such as data removal and asset recovery and installation services of new equipment. From a customer perspective, it appears that these manufacturers are managing these services themselves, including the refurbishment and resale of used goods. It is unclear if these functions are delivered by the producer directly or as an outsourced function, however the service is in many cases offered under the producer's brand name. This is the case for HP and IBM, both of which have invested in or partnered with electronics recycling companies in the US and Europe. Other producers cooperate with

brokers and other service providers to manage the resale of products. Whether or not these manufacturers plan to fulfil the WEEE Directive's take-back obligations using these programmes alone is unclear, and if these systems will be coordinated on a national, pan-European or global level.

WEEE from consumers

Although limited, there are a number of producers that have encouraged the take-back of their products from households through various channels. Dell Computer for example, extends its web-based take-back programme to private customers and B2B. Dell EMEA,[14] offers free take-back of computer systems of any brand when purchasing a new Dell system. Additionally, customers with Dell products are also eligible for free take-back without purchasing new Dell products. The company's Global Recycling Policy[15] officially supports individual responsibility, which includes the take-back of computers mentioned above, and declares to expand these operations globally where their business grows. Dell Computer does not envisage this service to be their main approach to compliance with Member State WEEE law, and will develop their approach to compliance on a state-by-state basis.

Additionally, certain producers have organised collection events, with or without retailer involvement, to promote responsible end-of-life management. Whether or not producers apply for credit towards their obligations of historic waste is uncertain. In the case of Dell and HP, which have organised events in Ireland and Germany respectively, only HP plans to report this to the national clearing-house/registry.

2.8 Varying forms of implementing individual responsibility

Although individual producer responsibility is often perceived as being harder to implement, whether within collective systems or via individual producer compliance 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, categorised according to 1) when and how discarded products are distinguished from the rest and 2) how producers involve themselves in the downstream operation.

2.8.1 Distinction when collecting from end-users

In some cases, the brands of products are already distinguished when products are collected from/handed in by consumers. This is the case when users of many products are businesses, but measures to collect products of specific brands from households also exist. Some 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, 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. The arrangements with recovery facilities and collection from end-users are organised either by producers themselves, or out-sourced to a third party. However, what is

[14] EMEA stands for Europe, Middle East and Africa.

[15] Found at: http://www.dell.com/downloads/global/corporate/environ/recovery_policy.pdf.

common is that all the producers have control over management of their products. Table 2-1 summaries the examples cited.

Table 2-1: 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 license from the producer responsibility organisation (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

2.8.2 Distinction at intermediary collection points

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 2-2.

Despite the rather negative perception of some interviewees that 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 an economy of scale with regard to transport and management of collection points, while giving them greater potential for control over their 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.

Table 2-2: 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 producer responsibility organisatin (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

2.8.3 Distinction at recovery facilities

Table 2-3 summarises cases where the brand names of discarded products collected and transported together to recovery facilities are distinguished at recycling plants. In the examples presented, the physical management of products is performed collectively, namely, at least under the current operation, 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 prior to the recovery operation. The involvement of producers in collection and recovery activities decreases, especially in the case of ICT producers in the Netherlands and Switzerland. However, they have a mechanism of "grasping" products that reach recovery plants. In the examples provided, the degree of design for end-of-life has not been reflected in the amount paid by producers, but they illustrate the possibility of distinguishing between brands and models of products at recycling facilities.

Table 2-3: 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 sends 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 of a respective brand.	PRO makes the overall arrangement. Producers pay in proportion to the amount of their products to the PRO.	Visible flat advance disposal fee

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

3 EPR Programmes and evidence of design change

When discussing how EPR programmes stimulate design change by manufacturers, it is important to recognise that the determinants of product innovation may come from a variety of sources, of which EPR requirements are only one. However, these sources are often not mutually exclusive and are inherently interconnected. Therefore, attributing change to any one source may not even be possible or desirable. Answers from actors on the question of motivating drivers for change, are highly dependent on who is asked. This is characterised by the supplier/OEM example. Depending whether you ask the supplier or the OEM – the reasons for design change might be either market-driven (in the case of the supplier) or regulatory-driven (in the case of the OEM) on an issue like the driver of a government-mandated phase-out of a particular substance.

In the following section, empirical evidence is presented that unequivocally illustrates that manufacturers have designed their products to meet anticipated and existing demands from EPR law.

3.1 Evidence of design change in response to EPR Programmes

Tojo (2004) conducted a study in 2000-2001 of manufacturers of EEE and cars in Sweden and Japan. She investigated their perception of the role of EPR on their environmentally-related activities and especially on their environmentally-conscious design development. The study was primarily based on interviews with representatives of 13 EEE manufacturers (9 in Japan and 4 in Sweden) and 8 automotive manufacturers (5 in Japan and 3 in Sweden).

One of the main findings of the study is that EPR does provide tangible incentives for environmentally-conscious design. Analysis of the interviews showed that *all* the manufacturers interviewed consider regulatory requirements in their product development strategies, in this case the anticipated requirements posed by EPR law. Meanwhile, apart from Swedish EEE manufacturers, consumer demand as a driving factor is either non-existent (car manufacturers) or very low (EEE manufacturers in Japan).

Upstream measures, both in terms of reduction of hazardous substances (discussed in Section 3.2) and enhancement of source reduction of material use, re-use and recycling, have been undertaken in the two industry sectors in both countries. Concrete measures taken by Japanese EEE manufacturers can be found in Table 3-1 and 3-2 below. Manufacturers have made careful consideration so as not to increase the environmental impacts incurred during other phases of the life cycle in favour of design changes that facilitate end-of-life management.

In terms of producer compliance strategies all Japanese manufacturers of large appliances interviewed belong to one of two main groups. One group (Group A) consists of manufacturers who agreed to use existing infrastructure as much as possible. For collection, they had many retailers selling their brand products, and decided to use these retailers for their take-back obligation. Likewise, except for the plants they manage themselves, as discussed below, they made contracts primarily with existing recyclers and worked with them. The other group (Group B) consists of manufacturers who established their own recycling plants and recycle their end-of-life products themselves. Within the respective groups, producers co-operate with each other in establishing regional aggregation stations, take-back networks and recovery and treatment facilities.

It is important to note, however, that all prominent manufacturers in both groups have established and manage at least one recycling plant themselves to facilitate communication between the upstream and downstream and to grasp the actual recovery costs. This has greatly helped communications between designers and recyclers. For example, at Mitsubishi Electric Corporation, a three-day seminar was held for designers, inviting personnel from the recycling plant as lecturers and letting designers experience the dismantling of a discarded product.

In future, the cost for end-of-life management of the products that are developed now would be borne by the manufacturing plant. The manufacturing plants thus consider 1) personnel costs at the recycling plant (how long does it take to dismantle products), 2) expected revenue from recovered materials and 3) disposal costs (for materials that cannot be recycled and/or costs of materials recovery). (Takahashi, 2003, May 23-24, personal interview).

The analysis indicates that while the reduced use of hazardous substances has been undertaken by virtually all manufacturers, the level of activities in areas of reduction of material use, re-use and recycling varies. In general, the more control manufacturers have over the downstream infrastructure, the more likely they are to take measures belonging to the higher ladder of resource efficiency. The study also revealed anxiety among manufacturers concerning the development of downstream infrastructure. The manufacturers feared that current development does not allow for the distinction of their products from products of similar types. It means that their upstream efforts may not be adequately rewarded.

Table 3-1: Examples of criteria and concrete measures taken to enhance resource efficiency and recyclability by EEE manufacturers in Japan

Assessment categories	Examples of criteria and concrete measures (concrete measures in parentheses)*
Reduction of material use	• Light-weighting: eg home audio equipment, video camera, digital camera (Sony), 10% reduction by reducing 9 components in air conditioners (Toshiba) • Material reduction: eg 35% reduction of copper wire used in the compressor of air conditioners by adopting concentrated winding system (Toshiba) • Miniaturisation: eg lap-top computers (Hitachi)
Prolongation of products' life	• Modular design/component re-use: eg copying machines, toner cartridges, personal computers (NEC, Ricoh, Fujitsu) • Upgradeability: eg provision of upgrading service for personal computers (Sharp) • Reconditioning and re-manufacturing: eg copying machines (Ricoh) • Ease of repair and maintenance: eg securing spare parts (Ricoh, NEC), design for disassembly (see below)
Ease of disassembly /separation	• Unification of materials: eg use of PS for components and for screws (Hitachi, Sharp), abolishment of use of composites of metal and plastics in TV sets (Mitsubishi) • Reduction of number of components and screws (Hitachi, Matsushita, Mitsubishi, Sharp, Ricoh) • Design for disassembly: eg disintegration of battery from the main body of mobile phone (Toshiba), two-direction disassembly of washing machines (Hitachi, Mitsubishi), standardisation of screws in TV sets (Mitsubishi)
Recyclability of materials	• Unification of materials: eg use of magnesium alloy for TV cabinets and personal computers (NEC, Hitachi, Fujitsu, Matsushita, Sony), standardisation of types and grades of plastics (Matsushita, Sharp, Mitsubishi, Ricoh, Hitachi) • Labelling of plastics (Mitsubishi, Hitachi, Sony, Fujitsu, Ricoh, NEC) • Metallic painting (Fujitsu) • Development of "eco-polica", a type of plastic with low-flammability which can be recycled more than 5 times and produces no dioxin (NEC) • Use of recycled plastics: eg 30% in copying machines (Ricoh), 35-40% in computers (NEC)

Source: Fujitsu (2000), Hitachi (2000), Matsushita (2000), Mitsubishi (2000), NEC (1999), NEC (2000), Ricoh (2000), Sharp (2000), Sony (1999), Toshiba (2000).

* Although more than one example was found for most of the criteria, only one or a few examples are given to illustrate the measures.

More recent activities of producers in the area of product design for end-of-life, including improvement in systems for collecting and processing WEEE, indicate that the above-mentioned legislative drivers would still apply to today's conditions. For example, HP notes that its design for environment guidelines (which are used by product designers) derive from evolving customer expectations and regulatory requirements, but they are also influenced by the personal

commitment of its employees. Two of the three priority areas of HP's design for environment programme - materials innovation and design for recyclability are connected to the specific goals of the WEEE and RoHS Directives. HP's materials innovation strategy includes efforts to reduce the quantity of materials used in products and develop materials that have less environmental impact and more value at end-of-life, while the Design for Recyclability strategy involves designing equipment that is easier to upgrade and/or recycle.[16] Figure 3-1 below from HP's 2005 Global Citizen Report was used to illustrate the company's efforts to improve design for recycling of their products.

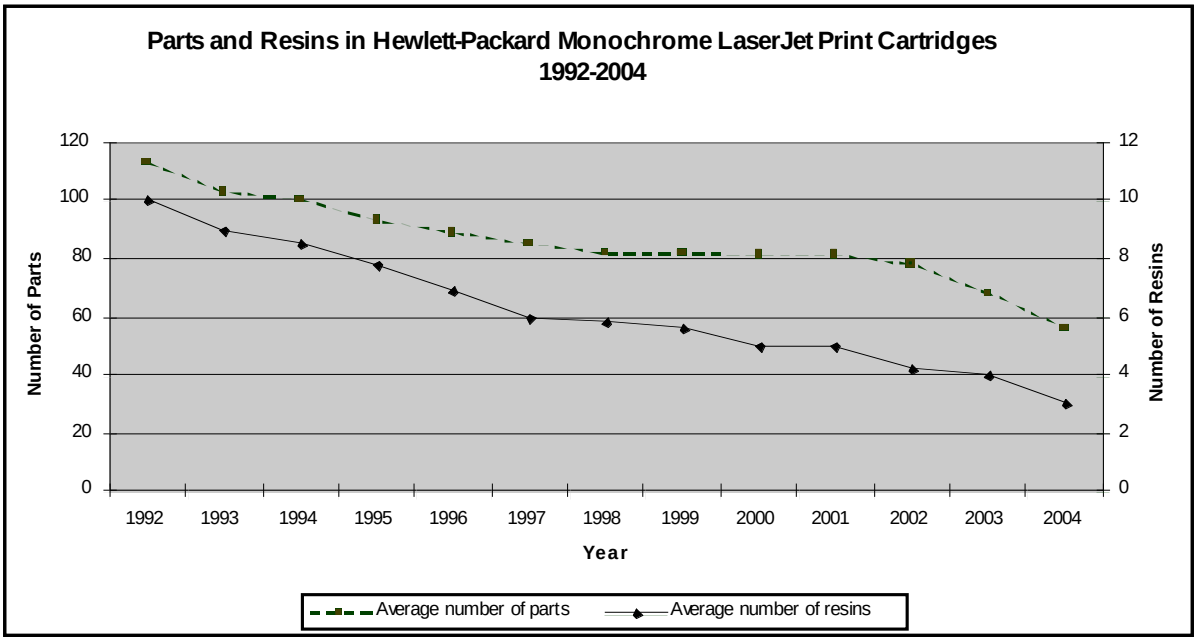

Figure 3-1 Parts and Resins in Hewlett-Packard Monochrome LaserJet Print Cartridges 1992-2004

Source Hewlett Packard 2005 Global Citizen Report

3.2 Directive 2002/95/EC RoHS – Severely impacting product design

Directive 2002/95/EC on restricting the use of certain hazardous substances in electrical and electronic equipment (RoHS) was originally included in provisions of the WEEE Directive. It was subsequently moved to become a separate Directive falling under Article 95 of the EC Treaty, whose legal basis is the functioning of the single market, which means that EU Member States cannot go further than the requirements in the RoHS Directive, eg banning further hazardous substances. In addition to the harmonisation of substance restrictions across Member States, the Directive also aims to "contribute to the protection of human health and the environmentally-sound recovery and disposal" of WEEE (Art. 1). The Directive bans the use of cadmium (Cd), mercury (Hg), lead (Pb), hexavalent chromium (chromium VI) and two brominated flame-retardants: polybrominated diphenylethers (PBDEs) and polybrominated biphenyls (PBBs) by 2006, with exceptions in some applications. These substances are to be banned from EEE products because of the associated impacts when improperly disposed of in incinerators or landfills. According to the European Commission, even though the WEEE Directive mandates the separate collection of EEE products, the 'soft' recovery rate of

[16] Hewlett-Packard 2005 Global Citizenship Report. Available at: http://www.hp.com/hpinfo/globalcitizenship/gcreport/pdf/hp2005gcreport.pdf , pg. 20

4 kg/person/year will still allow for significant disposal of ICT, and therefore the banning of these substances is required.

Several electronics industry observers have estimated that the WEEE and RoHS Directives will have a wider impact on the sector than the Y2K[17] bug, which similarly mobilised the industry on a global level to meet encroaching deadlines. This is characterised by numerous statements made by industry analysts or company representatives.

> "The electronics industry is facing one of our greatest manufacturing challenges as we make the transition to lead-free production." Dr. Gordon Fischer, Henkel Corporation. Source: EMSNOW http://www.emsnow.com/ Feb 3, 2006
>
> "Product-based environmental regulations are driving a revolution in design, manufacturing & end-of-life management of electronics" Joe Johnson, Cisco Systems Inc. Source: Presentation by NIST Workshop, October 2005 available at: http://www.cstl.nist.gov/nist839/RoHS/Presentations/Johnson100505.pdf

[17] Y2K stands for year 2000

Table 3-2: Examples of measures taken in relation to elimination/reduction of hazardous substances by EEE manufacturers in Japan

Type of Development	Examples of commercial application / stated targets (as of 2000)*
Lead-free solders	• Tin and silver based: large computers since 1989 (Hitachi), head-phone stereos and portable MD players as of March 2000 (Matsushita) • Tin, silver and copper based: started to apply in laptop computers, 8mm cameras, washing machines and air conditioners since 1999 (Hitachi) • Tin and copper based: application in video player (Matsushita) • Aimed for complete elimination by the end of 2002 (Fujitsu), by March 2003 (Matsushita) • 50% reduction for the products sold in 2001, compared to 1997 level (NEC)
Halogen-free flame retardants	• Printed circuit boards of personal computers (Matsushita, Hitachi) • Parts of air conditioners, washing machines and TV sets (Hitachi, Matsushita, Toshiba) • Application of silicon based flame retardants in personal computers, liquid crystal display monitors and projectors (NEC) • Aims to eliminate PBB and PBDE for all plastic parts by September 2000 (Sharp) and all brominated flame retardants at a later date
Elimination/ Reduction of PVC	• Introduction of PVC-free cables and metal plates, and 20% reduction by 2002 compared to 1997 level (NEC) • PVC free components in TVs, refrigerators (Hitachi) • 50% reduction from cables by 2001 compared to 1997 level (Ricoh) • Aimed for complete elimination by March 2003 (Sharp)
Substitution of Ozone-depleting substances	• Use of cyclopentane foaming agent instead of HCFC-141b to all refrigerators by March 2005 (Mitsubishi) • Application of HFC R410 in the majority of air conditioners (Toshiba) • Aimed for complete elimination of HCFC by December 2004 (Toshiba)
Elimination/ Reduction of Chromium VI	• Application of chrome-free metal plates in all the products from 2001 (Ricoh) • Application of chrome-less metal plates in personal computers, telephone exchange stations (NEC) • Elimination of chrome from audio tapes (Sony)

Source: Fujitsu (2000), Hitachi (2000), Matsushita (2000), Mitsubishi (2000), NEC (2000), Ricoh (2000), Sharp (2000), Sony (1999), Toshiba (2000).

* Examples are not exhaustive.

Other evidence confirming the global shift to lead-free electronics can be found by taking a closer look at the number of component manufacturer discontinued parts over time. Discontinued, or end-of-life (EOL) parts, are components that are no longer produced or supplied by manufacturers to the market. For example, in 2000 there were a total of 90,000 EOL announcements, while in 2004 this figured was estimated up to 150,000 (Jorgensen, 2005). Original Equipment Manufacturers (OEM) must choose whether to purchase remaining stock, ask distributors/suppliers to purchase on their behalf, or redesign that part out of the product. Either way the manufacturer bears the cost of redesign or having shortages or surpluses of certain components. Given that passive and semi-conducting components are highly commoditised, it is not surprising that when one market segment (Europe) bans the use of certain hazardous materials in components, the feasibility of having multiple product-lines is questionable. With recent RoHS-like law in China and California, the argument for a global switch to lead-free and other hazardous materials reductions is only reinforced. This global phase-out strategy has been confirmed by some of the world's largest producers of IT equipment, including HP[18], Sony[19], Dell, Toshiba, Samsung, with many Japanese manufacturers

[18] 2005 HP Global Citizenship Report pg. 9 Available at: http://www.hp.com/hpinfo/globalcitizenship/

[19] Sony CSR Report 2005: Avaialble at http://www.sony.net/SonyInfo/Environment/

superseding the RoHS 1 July 2006 deadline by several years. Green procurement requirements set by Sony, Hitachi, NEC, Toshiba, and other Japanese companies caused global suppliers to remove hazardous substances years before RoHS took effect in July this year.[20] Japanese electronics manufacturers had been moving forward with these developments in an attempt to increase European market share in advance of the compliance deadline (Murphy & Pitts, 2001).

Although this has positive implications for ensuring that manufacturers meet the July 2006 deadline for the phase-out of lead, this trend may have negative implications when discussing re-use opportunities for products put on the market before July 2006. Despite the exemption of spare parts for repair and re-use of EEE put on the market before 1 July 2006, the requirements in RoHS may accelerate the reduction of available spare parts. However, on a positive note, it may also increase demand for removal of these components from end-of-life products collected from B2B customers or municipal collection sites.

3.3 Corporate Statements on the impact of WEEE on product design

Evidence of the WEEE Directive's impact on product design can also be found through public statements found in producers' own literature. For example, in Dell Computer's 2005 Sustainability Report the following observation was noted.

> "Dell's Sustainability team included an interactive session in Europe about emerging WEEE law and new European chemical law, *which have and will change both product design and service programs in the coming years."*

Similarly, on Electrolux's web pages dedicated to the WEEE Directive the following statement was noted.

> "WEEE is creating new opportunities for Electrolux, both in product design and operational efficiency." Source: http://www.electrolux.com/node215.aspx

Under the web pages titled 'Recycling' further evidence of the impact of the WEEE Directive is found.

> "Electrolux is an early advocate of producer responsibility. We were among the first in our industry to identify the business case for recycling and lobby actively for individual responsibility." Source: http://www.electrolux.com/node195.aspx

3.4 Design Change in the Automobile Sector

Interviews with car manufacturers (five in Japan and three in Sweden) conducted in 2000-2001 revealed the EU ELV Directive to be an important driving force for their design change strategies.[21]

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[20] Available at: http://www.emsnow.com/npps/story.cfm?ID=16472

[21] The manufacturers interviewed include Fuji Heavy Industries Limited, Isuzu Motors Limited, Mazda Motor Corporation, Nissan Motor Corporation, Ltd., Toyota Motor Corporation, Saab Automobile AB, Volvo Car Corporation and Volvo Truck Corporation.

Concrete design changes made by manufacturers in both countries concern the reduction in use of hazardous substances, the enhancement of component and material re-use, design for dismantling and recyclability and the use of recycled materials.

Regarding hazardous substances, all five Japanese manufacturers interviewed referred to the reduction in the use of lead in their products. The majority of the manufacturers interviewed achieved the reduction target (50% of the 1996 level set down in the Japanese Automobile Manufacturers' Association's Voluntary Action Plan) by 1999. Other substances mentioned include cadmium in paint, hexavalent chromium on metal plates, mercury and chlorinated substances.

All the Swedish manufacturers interviewed had developed and used lists of substances targeted for phase-out, which are provided to suppliers as part of the product specifications. For instance, a list would be included in the drawings and technical specifications. In another case, requests have been made to suppliers to provide them with information on the quantity of substances on the list and the supplier's action plan to eliminate them. Car industries in Europe have developed a common database system called IMDS, where their suppliers were required to input information such as substance use. Once completed, individual manufacturers would be able to receive information on materials constituting the components of each car through the database.

Regarding component re-use and recycling, by collaborating with existing dismantlers, Nissan established a network for spare parts (Nissan, 2000). Volvo Truck, Nissan and Toyota initiated refurbishment and sales of second-hand parts. Volvo Car involved a large dismantling company in the management of re-used components and relies on the dismantler to supply some spare parts whenever necessary.

Concerns have been raised that the EPR law would make spare parts less available in future. It seems, however, that these concerns have been premature, or rather theoretical, and that there will be good access to spare parts from domestic or foreign sources.

In addition to measures already taken to ease repair, such as oil-change and parts repair, examples of design for dismantling include reduction of the number of screws, unification of materials used in one component, such as use of polypropylene (PP) in instrument panels, unification of several components into one (also found in instrument panels) and so on. Regarding material use, a measure commonly found was the increased use of thermoplastics, such as PP and thermo-plastic olefin. The unification of the grades of PP and marking of plastics was also widely adopted. Toyota succeeded in developing thermoplastics called TSOP (Toyota Super Olefin Polymer) that can be recycled for the same purpose (recycling instead of down-cycling),[22] while having other properties such as durability and mould-ability (Toyota, 1998). It also started to use polyurethane and fibres recovered from auto-shredder dust as noise buffers in new cars (Toyota, 1998).

A prevailing form of material recycling was the recycling of bumpers to internal parts, such as undercovers, engine covers, trunks and the like. Some manufacturers have overcome the challenge of peeling the paint applied on bumpers with minimal environmental burden and cost, and started to recycle bumpers into bumpers. Other parts used for material recycling include instrument panels, carpets, instrument ducts, glass and similar. Fuji Heavy Industry established a system of collecting glass from end-of-life vehicles and recycling it for glass wool. The idea

[22] Further discussion on recycling instead of down-cycling can be found in Peck (2003).

was developed together with a neighbouring dismantler and a glass manufacturer. Apart from the materials recovered from cars themselves, materials from other products, such as PET bottles, plastics on the roofs of greenhouses and glass from construction waste, have been used in cars.

The recycling goal set out in the EU ELV Directive has led to a number of activities to improve the possibilities of achieving the goals, including providing detailed information to dismantlers and labelling plastic parts. Such measures have clearly improved the chances for clean material cycles. A considerable amount of research has also been devoted to taking care of the shredder residues in an environmentally-acceptable and financially viable way. For instance, SAAB conducted a pilot project with their suppliers where several types of materials were scrapped in batches. These materials were transported, shredded and ground, and were used by some suppliers to make parts such as wheel housings and interiors. Materials gathered in this project were those easily taken from the cars, such as polypropylene (PP).

In terms of providing a feedback mechanism from end-of-life management back to design, there have been numerous experiences by car manufacturers, at least in the pre-ELV Directive period. At the beginning of the 1990s, BIL (the Swedish Car Manufacturers' and Wholesalers' Association) created an ad hoc group to understand and discuss car recovery. ECRIS (Environmental Car Recycling in Scandinavia) emerged six to twelve months later and was created as a cooperation between different partners (a car manufacturer and some vehicle dismantlers). It presented additional information covering the technical and economic aspects of car scrapping and recycling. In the end, together with ECRIS the group in BIL came to an agreement with the Swedish Government to work on a full-scale test of car recovery. The ECRIS project continued for four years.

To avoid paying dismantlers an unnecessarily high price for recovery, Swedish car manufacturers established internal workshops for dismantling and scrapping activities. In one company, test cars and cars used in the crash-test laboratory were dismantled in the workshop. This brought them multiple benefits. First, they learnt about time and cost for dismantling, the methodology and equipment that should be used, etc. This also enabled designers to learn about design for end-of-life. The company also did not have to collect from dismantlers components that are still confidential. The company also investigated the possibility of reconditioning some parts.

The ELV Directive also improves the possibilities to de-pollute the cars and in general improve the activities of car scrappers by providing financing for dismantling activities when necessary.

4 Discussion

In this section various critical issues raised in the previous sections are discussed to highlight their relative importance in terms of influencing product innovation. These mainly centre on the various understandings of individual-versus-collective responsibility and the arguments and counter arguments over their implementation. The section also examines potential product groups to be covered by EPR and how it might be applied in non-OECD countries.

4.1 Developing Incentives to stimulate Design for Environment

In terms of EPR programmes providing incentives to producers to design products for improved environmental performance from a life cycle perspective with a specific focus on end-of-life, the arguments are fairly straightforward – that is if a producer is financially responsible for his own products at end-of-life, then he/she will be rational and design products to minimise this cost. Of course not all producers would consider this cost as a decisive factor influencing design (especially weighing all design factors), however many have anticipated that this cost to be significant and have changed product design accordingly. When we consider substance restrictions as falling under the umbrella of EPR, design change implications are even more evident, especially in global market product groups such as electronics. It is crucial that to maintain this trend, EPR programmes are designed so that these producers' efforts have at least the possibility of being acknowledged in terms of differentiated end-of-life costs when and where they are realised.

4.2 Applicability of expanding EPR to more product groups

We see the applicability of expanding EPR to more product groups divided into three distinct approaches, each of which is discussed below. Two of these fit into the traditional application of EPR manifested in take-back and recovery target type programmes, while the third is a more novel application of the EPR principle.

In terms of expanding the application of EPR, Canada (particularly British Columbia) and Sweden have between them developed mandatory EPR programmes for the greatest number of product categories worldwide. These countries' experiences highlight the potential for other countries that have so far not included the full spectrum of product groups to expand their programmes accordingly. This provides the first concrete way of expanding EPR to more product groups, particularly at EU level. Typical product groups that might be considered include newsprint, textiles, household paints and solvents, tyres, pharmaceuticals, and other general household hazardous wastes, all of which have been included in EPR programmes to date.

Second, given the diverse number of products consumed and disposed of in modern society, the possibilities of expanding EPR programmes to problematic product groups that have not previously been targeted seems plausible. However, surprisingly little is known about the occurrence of these products in the waste stream. Most statistics on municipal solid waste composition provide data only by material composition of waste such as organics, glass, plastic, paper, aluminium, steel, etc. Identifying additional products that are likely candidates for EPR programmes therefore requires some inherent knowledge by waste management authorities at municipal level and also calls for more transparent data collection. Despite this current data gap, a number of product groups stand out as possibilities for EPR programme expansion. Furniture, children's toys and construction materials have been considered as potential candidates in this area but their often long lifespan presents challenges in assigning responsibilities. Owing

to their current design these product groups will often be hard to recycle from a material perspective without product redesign to ease recycling.

Given the wide definition of the EPR principle as used in this report, the extension of responsibility to producers can be expressed in formats that vary considerably from traditional applications to date. For example, although it may not be feasible to develop take-back programmes for all products consumed in society, the provision of key information by producers to stakeholders at various life cycle stages including retailers, consumers and end-of-life operators may aid in reducing harmful environmental impact. Additionally, extending producer responsibility to other life cycle phases in addition to the end-of-life stage may encourage new business approaches that include delivering the products' function rather than the product itself. Regulating product-specific characteristics and the environmental performance of products, for example, material content and resource consumption during the use phase would fall under our wider definition of EPR. Therefore, if the "conventional" EPR programmes failed to create the necessary design change incentives on their own, more direct intervention might be justified.

4.3 Applicability of EPR for non-OECD nations

When considering the applicability of expanding EPR programmes to non-OECD nations it is important to take into account several factors. Given that the wealthier sector of the population in these countries purchases and uses products that EPR programmes would typically target to a much higher extent than the rest of the population, the reason for introducing them is strengthened. The wide disparity between wealthier consumers and the poor justifies action to ensure that the producer or consumer and not the general taxpayer is responsible for the management of end-of-life products.

Since the definition of EPR as a principle (as used in this report) would consider substance restrictions in products to fall within the possible scope of any EPR programme, this is a highly relevant consideration for non-OECD nations which are considering EPR law. Material restrictions in products would help to reduce environmental impacts occurring in the end-of-life phase, both in countries without EPR programmes and those with 'leaky' EPR systems, where not all the products are captured in the EPR programme. Given that material restrictions are in place that have an impact on the global electronics sector (namely the RoHS Directive), it would be advisable for any nation implementing EPR law to, at the very least, enforce the same requirements to avoid becoming a dumping ground for any global excess of components containing these restricted materials. This would also avoid investment in manufacturing equipment that would lock in the use of these restricted materials (namely lead) for a considerable period. Given that a considerable proportion of both EEE manufacturing and re-use/recycling of WEEE takes place in non-OECD countries, the benefits of non-toxic products are realised in both phases of the product life cycle.

Considering that WEEE type law is an increasingly targeted product group, it can provide an interesting context to illustrate some of the potential issues that might arise. Since many non-OECD countries are net importers of used EEE, this provides challenges that have not previously had to be addressed to any great extent in OECD countries. Depending on the relative market share of these imports compared with new sales, identifying a responsible 'producer' may be crucial for the success of any programme. This is because the local producers or importers of *new equipment* may end up paying for the management of these used products at the end-of-life, either as orphans (if not identifiable) or as their own brand (if the imported used products' brand names are the same as the new products), depending on how the financing mechanism is established. In addition to this, there may also be potential issues of free-riding in terms of producers of new products. Preliminary research has indicated that there may be a

strong presence of non-branded products on the market (particularly for computers) whose producers may benefit from the EPR system without paying into the system. Identifying obligated producers may prove difficult and the potential impact this might cause should be thoroughly considered. What must also be considered is the fact that in many cases, used EEE sent from OECD countries may more appropriately be categorised as WEEE, which are considered as hazardous waste under the Basel Convention. Given the Convention's envisaged ban on the export of hazardous waste from OECD to non-OECD countries, the import of WEEE should be banned by non-OECD countries. Imported used EEE which ends its life in non-OECD countries should be adequately addressed in any EPR programme.

This raises another issue that, as far as we can identify, has never been applied in practice. If the imported used product came from a jurisdiction that had an existing EPR programme where a financial guarantee was allocated to the product or even perhaps an advanced disposal fee, provisions that have been made to recycle the product in the country of first owner should be transferred with the used product to the country that imported it for re-use. Whether or not there is legal justification for such a transfer has not been determined, but this is worth considering for future research and could help alleviate any fear by local producers that they would be subject to EPR law. Another alternative might be to capture the importer as the local producer, but this would very much depend on the nature of such imports and the relative control the authorities had over this issue.

There has also been concern that any EPR programme might have a negative impact on established re-use markets, but experience from Europe and North America indicates that this is not so. If a well-functioning re-use market already exists, consumers would not be likely to dispose of their products if, for example, they could find a willing buyer. But this needs further investigation to rule out any potential negative impacts, eg producers seeking to limit the second-hand market to boost sales of new products.

As referred to in the first chapter of the report, EPR systems can improve the recycling conditions by regulating the de-contamination steps to be taken at dismantling facilities. Improved recycling conditions will also bring safer working conditions for recyclers and reduce environmental contamination at and around dismantling and recycling workshops. Care should be taken that existing recyclers, often operating with limited access to capital, are given a reasonable chance to upgrade their activities and continue to work in the sector when new demands on operations are introduced. It is obvious that government may have to intervene with both regulations and financing to allow a smooth transition from today's systems.

All the above potential concerns are applicable to EPR programmes, regardless whether they are based on individual or collective financial responsibility. The potentially large import of used products and non-branded new products will clearly need to be addressed to ensure that any EPR programme design would be financially-sustainable. If the total contribution of end-of-life products from these sources is high, then the financial burden would fall on more recognisable local and international brands. Europe has addressed this by ensuring that a financial guarantee is provided for all new products on the market, although there appear to be legal loopholes, which allow for the spirit of this requirement to be circumvented.

4.4 Individual Financial Responsibility does not necessarily equate to duplicated infrastructure

It is clear that it is, and has been, possible to implement elements of individual financial responsibility within collectively-organised industry-run compliance schemes for a range of EEE and cars. Therefore this phenomenon may be better described as a continuum between

individual and collective approaches, where it is possible to have both completely collective and completely individual systems for compliance, and hybrid-type systems which are designed to include the strengths of both systems, all operating simultaneously. The fact that EPR law is meant to be goal-oriented, and not prescriptive, suggests that producers should be allowed to collectively organise (one or competing) take-back and recycling systems. In fact, in many cases it may be rational to do so from both an economic and environmental perspective. But it is important to maintain individual financial responsibility for one's own new products in any programme developed. What is particularly important is that EPR law allows for producers that want to develop individual systems for collection and recycling to do so without penalty.

The ELV system introduced in Sweden is a good example of individual financial responsibility without duplication of infrastructures for dismantling and recycling. Car manufacturers in Sweden, and importers, have decided to take advantage of the well-functioning part of the established dismantling and recycling companies and have consequently signed contracts with these actors. This means that a specific dismantler may serve many, maybe all, manufacturers, but having an individual contract with each of them.

The ELV management system which started in January 2005 in Japan is also based on individual financial responsibility. All manufacturers and importers must announce the end-of-life management fees of their products. The fees announced in mid-2004 ranged from ¥7,000 to ¥18,000 (ca €50-130), varying not only between brands and sizes but also between models of the same brand (Automotive Department, METI, 2004; Oonishi, 2004). Unlike the system for four large appliances, an advance disposal fee system has been chosen. Car producers in Japan are responsible – physically and financially – for the management of auto-shredder residues, ozone-depleting CFCs and airbags, and must achieve recycling and recovery targets for auto-shredder residues which gradually become more stringent. Similar to the development of the four large appliances, the car producers established two groups to organise their take-back and recycling responsibilities. However, out of 27 recycling facilities, 18 have contracts with both the groups (Tanaka & Oonishi, 2005).

The mandatory take-back of personal computers from households, introduced in Japan in October 2003, is also based on individual responsibility. The existing postal service is used as a collection infrastructure (Personal Computer 3R Promotion Centre, 2006b). Concerning the new products (on the market from 1 October 2003), the costs for end-of-life are internalised in the price. The end-of-life management cost for old products should be paid by the last owner (the fee announced by the manufacturers has been the same across all manufacturers) (Personal Computer 3R Promotion Centre, 2006a). To distinguish between old and new products, producers developed a marking system. But the programme does not require a safe guarantee to secure finance for future orphan personal computers, a loophole that must be addressed.

5 Conclusions

5.1 The impact of EPR on the environment and innovation

Throughout this report empirical evidence has been provided that clearly illustrates that the environmental performance of products subject to EPR law has improved, particularly regarding hazardous materials reduction and improved recyclability and recycling. There are studies of the impact of EPR law. Moreover, manufacturers themselves have openly declared the impact that the development of the ELV Directive, and the WEEE and RoHS Directives, have had on product design.

What is also evident is that these changes have so far been more the result anticipating such regulatory requirements, than of the actual incentives provided when the EPR programme is implemented. It is worth remembering that most producers during the beginning of EPR discussions viewed EPR as a future demand to manage their own products, that is, what later came to be called "individual producer responsibility". The drivers of eco-design are strengthened when there is feedback on total end-of-life costs to individual producers – namely collection, dismantling, re-use and high-levels of material recycling – through implementation of individual responsibility.

5.2 Possibilities for implementing individual responsibility

We see that the debate over individual-versus-collective responsibility with respect to their ability to provide incentives to producers to design their products for improved end-of-life processing, although easy to conceptualise, has lead to confusion among many actors involved in the debate over implementing EPR. There seems to be a common misunderstanding that individual financial responsibility will always imply an individual physical responsibility translating to individual systems for collection and treatment of WEEE. This is clearly not correct and there is evidence that individual financial and individual physical responsibility does occur in systems operating today.

The reason for pursuing individual responsibility is to provide incentives for producers to strive to enhance the environmental performance of their products' total life cycle. In the light of this objective, and reflecting current practices, the meaning of practical individual responsibility can be expressed as follows.

A *producer* bears an *individual financial responsibility* when *he/she pays* for end-of-life management of *his/her own products*. A producer bears an *individual physical responsibility* when 1) the *distinction* of products is made at least by *brand* and 2) the producer has *control over the fate of their discarded products* with some degree of involvement in the organisation of the downstream operation. When products are physically handled together, the distinction of the products' *properties*, including their features on end-of-life management, should be made. Producers bear the *individual informative responsibility* for the aggregation and provision of information concerning the properties of their product and product systems.

Allocating *individual financial responsibility* to producers for historical products is limited from the viewpoint of design change. It may also create problems with providing adequate financing for orphan products. Historical products can be financed in a way which suits their respective society. But the physical involvement of producers would provide them with learning opportunities regarding design for end-of-life. An early indication of forthcoming EPR law is

deemed helpful to motivate producers to incorporate consideration of end-of-life management in their design strategies as soon as possible.

To develop EPR systems that drive design change, it is necessary to understand that only new products can be re-designed. Historical products, that is products that have been put on the market prior to the EPR law, will have to be taken care of, but how the costs are allocated will not directly affect development of new products. Incentives to change the design of new products come from the possible differentiation of fees paid for the end-of-life management. The costs of this will only arise at the time of disposal and can be hard to estimate for complex products such as cars and EEE. Financial guarantees for future costs are the way to ensure that producers take into account these costs when designing products and product systems. Financial guarantees, which not only ensure that there are funds to pay for these end-of-life costs, but provide flexibility and possibilities for competition on the market, thus allowing market forces to develop efficient solutions.

In addition to these minimum elements of individual responsibility, the current struggle to transpose the WEEE Directive and experiences of existing systems for EEE and cars exemplify other key issues that must be addressed to attain individual producer responsibility: These issues include: a) identifying all manufacturers and importers and their market shares; and b) distinction between historical and new waste by, for instance, marking products/components.

The distinction of products does not require the physically separate handling of individual producers' products. Existing practice where elements of individual producer responsibility exist within collective systems, suggests that the distinction of products can be made in various stages of the downstream operation. Timing of product identification includes: (1) the point when the end-user discards products, (2) at product aggregation points and (3) at recovery facilities. The methods of distinguishing products, the actors involved, and the roles of producers also vary. Influencing factors that affect the selection of the form of individual implementation include the end-value of products, feasibility and ambition of producers to establish their own downstream infrastructure, types of end-users, and the existence of other producers that share the same degree of ambition regarding end-of-life management of their products.

The key lesson from the European WEEE implementation to ensure that IPR can become a reality is the need to level the economic playing-field between various EPR schemes.[23] To do this, the following measures are needed to correct current distortions in favour of collective compliance schemes:

1. True financial guarantees for future waste costs
2. Internalising the full costs of end-of-life including collection, which in many countries continues to be subsidised by municipalities
3. Ensuring that the economic signal from treatment and recycling reflects the full costs of high-quality material recycling.

Environmental quality must be secured through demands of high-quality material recycling and not downcycling, that components and materials are re-used and that environmental problems are not simply exported to countries with insufficient law and even less recycling and waste management infrastructure than in OECD countries.

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[23] See IIIEE Report "Lost in Transposition – Implementation of Individual Producer Responsibility in the WEEE Directive (2006).

5.3 Further application of EPR principle

The application of the EPR principle can be expanded further, both in terms of targeted products and types of instrument used. The use of EPR programmes has been expanded geographically as well. When introducing EPR programmes in non-OECD countries, special consideration should be given to issues such as second-hand and non-brand products, waste disguised as recyclables, existing recyclers and inclusion of substance restrictions.

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Abbreviations

B2B	Business-to-business
EEE	Electrical and Electronic Equipment
ELV	End-of-Life Vehicle
EOL	End-of-Life
EPR	Extended Producer Responsibility
EU	European Union
HHW	Household Hazardous Waste
ICT	Information and Communication Technology
IPR	Individual Producer Responsibility
IT	Information Technology
MS	Member State (of the European Union)
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
PAYG	Pay As You Go
PP	polypropylene
PRO	Producer Responsibility Organisation
RoHS	Restriction of Hazardous Substances (Directive)
WEEE	Waste Electrical and Electronic Equipment
Y2K	Year 2000

Appendix I – European Directives embracing EPR

The European Commission has explicitly applied the principle of producer responsibility in two key Directives at EU level, namely the WEEE Directive 2002/96/EC and the ELV Directive 2000/53/EC. Although the Packaging Directive 94/62/EC as amended by Directive 2004/12/EC is not formally based on the EPR principle, most Member States have implemented it so that it at least partially includes aspects of it. The proposed Battery Directive adopted by the Commission COM(2003)723 final, which is intended to replace Directive 91/157/EEC, also explicitly applied the producer responsibility principle in terms of financial obligations for collecting and treating spent batteries and accumulators. This chapter aims to exemplify the development and implementation of EPR law by briefly describing the EU Directives for End-of-Life Vehicles, Waste Electrical and Electronic Equipment (WEEE) and Restriction of the use of Hazardous Substances (RoHS). For an in-depth analysis of the implications of the transposition of the WEEE Directive by Member States, see IIIEE report 'Lost in Transposition'.

Waste Electrical and Electronic Equipment (WEEE) Directive

Directive 2002/96/EC was adopted by the European Parliament and Council on 27 January 2003. Otherwise known as the WEEE Directive, the main objectives are to prevent the generation of electrical and electronic waste and to promote re-use, recycling and other forms of recovery to reduce the quantity of such waste to be disposed, while improving the environmental performance of economic operators involved in its treatment (Article 1).

It is not surprising that WEEE was designated as a priority waste stream, given the combination of increasing volumes of WEEE disposed of in the EU and the negative impacts associated with improper recycling, landfill disposal and incineration owing to the presence of hazardous substances in electrical and electronic products, not to mention a loss of valuable resources.

Directive 2002/96/EC covers a diverse scope of electrical and electronic equipment (EEE). EEE is defined as "equipment which is dependent on electric currents or electromagnetic fields to work properly and includes equipment for the generation, transfer and measurement of such currents and designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current" (Article 2(a)). There are altogether ten broad categories of EEE, including household appliances, IT and telecommunications equipment, tools, toys, and control instruments.

On the inclusion of the producer responsibility principle, the Commission notes, that "the establishment, by this Directive, of producer responsibility, is one means of encouraging the design and production of EEE which take into full account and facilitate their repair, possible upgrading, re-use, disassembly and recycling" (Recital 12).

For WEEE from (private) households, Article 5 of Directive 2002/96/EC obliges Member States (MS) to ensure that by 13 August 2005, systems are set up for consumers and retailers to return, at least free of charge, their end-of-life EEE. The Directive does not explicitly identify either producers or municipalities as the party responsible for setting up this infrastructure, and leaves the interpretation/discretion to individual MS. It also puts the onus on retailers to accept WEEE from consumers on a 1:1 basis when selling new products, although MS can deviate from this requirement if they can show that any alternative approach is no more difficult for consumers. For WEEE not from households, MS must ensure that producers or actors operating on their behalf provide for the collection and financing of this waste stream. For

household WEEE there is a collection target of 4 kg/capita/year, while for non-household-WEEE there is no target.

Article 6 outlines the requirement of producers to develop systems to treat WEEE using the best available treatment, recovery and recycling techniques in accordance with European Community law. Specific re-use and recycling targets, ranging from 50-80% depending on product category, and recovery targets (70-80%) are required. Annex II of the Directive outlines specific requirements for selective treatment of WEEE. The treatment requirements have a potentially significant impact on the current treatment paths employed in national WEEE schemes that were operating before and after Directive 2002/96/EC. These include the selective treatment requirement to remove circuit boards greater than 10 cm^2, mercury-containing components such as switches or backlighting lamps, and plastic containing brominated flame-retardants. The removal of these components before shredding would require manual disassembly, increasing significantly the costs of treating WEEE in certain categories.

Producers are required to finance *at least* the collection, treatment, recovery and environmentally-sound disposal of WEEE from households deposited at collection sites (Article 8.1). The significance of the terms 'at least', is that it extends the possibility for MS also to place the financial burden on producers for setting up and operating the collection sites.

On allocating financial responsibility for WEEE from households, Directive 2002/96/EC makes a distinction between historic and new WEEE. For products put on the market after 13 August 2005 (new products), each producer is responsible for financing waste from his own products, that is individual responsibility. To manage products put on the market earlier (historical products), producers should contribute proportionately according to their market share of that type of equipment (Article 8.2 -8.3). To distinguish between historical and new WEEE financial obligations for producers, Article 11(2) requires producers to mark products to differentiate between products put on the market before and after 13 August 2005.

This is meant to provide the necessary financial feedback mechanism to producers to design their products for better end-of-life management that results in lower treatment costs and environmental improvements. In a collectively-financed end-of-life management system where all costs are divided equally based on current market share, producers with better-designed products are financially penalised, as the cost savings attributed to their products are internalised by all producers in the system. But it is not possible for producers to influence the design of their products that were on the market before to the Directive came into force (historical waste).

When placing a product on the market (after 13 August 2005), producers must show that the management of all WEEE will have a financial guarantee (Article 8.2). This can take one of the following three forms: (1) participation by the producer in appropriate schemes for financing management of WEEE, (2) recycling insurance or (3) a blocked bank account.

Directive 2003/108/EC amends 2002/96/EC on financing non-household WEEE users. The Commission acknowledged industry concern over the impact of retroactive financial responsibility for historical WEEE, owing to changing market share structure over time. For historical WEEE, producers are only responsible when they supply new products on an old-for-new basis. The amendment does not change the obligation over individual responsibility for new waste.

Given that Article 8 (3) requires all players on the market today to pay a relative portion of the historic waste based on their market share, systems must be developed to record all new products

placed on the market by each producer and all historic WEEE collected. National registers must be established by MS to do this.

Restriction of Hazardous Substances (RoHS) Directive

Directive 2002/95/EC on the restriction of the use of certain hazardous substances in EEE (RoHS) was originally included in provisions of the WEEE Directive. It was subsequently moved to become a separate Directive under Article 95 of the EC Treaty, whose legal basis is the functioning of the single market, which means that MS cannot exceed the requirements in the RoHS Directive, eg banning further hazardous substances.

In addition to harmonising substance restriction across MS, the Directive also aims to "contribute to the protection of human health and the environmentally-sound recovery and disposal" of WEEE (Art. 1). The Directive bans the use of cadmium (Cd), mercury (Hg), lead (Pb), hexavalent chromium (chromium VI) and two brominated flame-retardants: polybrominated diphenylethers (PBDEs) and polybrominated biphenyls (PBBs) by 2006 with exceptions in some applications. These substances are banned from EEE products because of their associated impacts when improperly disposed of in incinerators or landfills. According to the European Commission, even though the WEEE Directive demands the separate collection of EEE products, the 'soft' recovery rate of 4 kg/person/year still allows significant disposal of ICT, so the banning of these substances is required.

End-of-Life Vehicles (ELV) Directive

Directive 2000/53/EC of the EP and Council of 18 September 2000 on end-of life vehicles (ELV Directive) stipulates as its objective to lay down "measures which aim, as a first priority, at the prevention of waste from vehicles and, in addition, at the re-use, recycling and other forms of recovery of end-of life vehicles and their components so as to reduce the disposal of waste, and at the improvement in the environmental performance of all of the economic operators involved in the life cycle of vehicles and especially the operators directly involved in the treatment of end-of life vehicles" (Article 1).

The Directive addresses vehicles and end-of-life vehicles, including their components and materials. It requires MS to encourage manufacturers to work on design for end-of-life, to use less hazardous substances, and to increase the use of recycled materials (Article 4.1). It also bans the use of lead, mercury, cadmium and hexavalent chromium after 1 July 2003 (with specified exceptions) (Article 4.2(a)).

"The economic operators shall set up collection systems with adequately available collection facilities. The vehicles shall be transferred to authorised treatment facilities and specific guidance given regarding the treatment operation. Member States shall establish a system where receiving certificates of destruction is a condition for de-registration of the end-of life vehicles (Article 5.1-5.3)."

"The last holder and/or owner must be able to hand in the vehicle, free of charge, to an authorised treatment facility even when the vehicles have no value or a negative market value. Moreover, Member States shall "take the necessary measures to ensure that producers meet all, or a significant part, of the costs of the implementation of this measure" (Article 5.4). This

requirement applies to cars put on the market from 1 July 2002, and from 1 January 2007 applies to all cars (Article 12.2).[24]

The Directive sets the minimum re-use and recovery rate requirement of 85% by weight, 80% of which should be fulfilled by re-use and recycling by January 2006[25] with the exception of cars built before January 1980.[26] The requirements subsequently go up to 95% (re-use and recovery rate) and 85% (re-use and recycling) by January 2015 (Article 7.2).

There are also standards for component and material coding, and producers must provide treatment plants with dismantling information (Article 8).

[24] This is not the case when "the end-of life vehicle does not contain the essential components of a vehicle, in particular the engine and coachwork, or contains waste which has been added to the end-of life vehicle" (Article 5.4).

[25] This means that 5% of WEEE can be incinerated with energy recovery.

[26] The requirements go down to 75% (re-use and recovery) and 70% (re-use and recycling).

Appendix II – Applications of EPR outside the EU

Also outside the EU, elements of EPR have been embedded in both national and provincial regulations and voluntary industry programmes on an industry branch or individual company level. Below are examples of such initiatives in the main regions of the world. It should be noted that this is not an exhaustive inventory of programmes worldwide but serves more to highlight the wide uptake of the principle.

Americas

Canada

Canada has widely embraced the EPR principle, although more often referred to as 'Product Stewardship' or 'Industry Product Stewardship' by governments and producers. All ten provinces have developed mandatory EPR programmes for a wide array of product groups. Products that are covered by mandatory programmes in some or all provinces include packaging materials, newsprint and fine paper, household hazardous wastes (HHW) such as paint,[27] motor oil, tyres, lead-acid batteries and WEEE.

British Columbia sets itself apart from other provinces by its approach to Product Stewardship, where initiatives for paint, drink containers, and motor oil are operated entirely by producers or "stewards" with no municipal taxpayer subsidies. There are also a number of nationwide voluntary programmes, namely for rechargeable consumer batteries, agricultural pesticide containers and beer containers.[28]

United States

Although there are no nationwide mandatory EPR programmes in the United States, there are several US-wide voluntary programmes, namely for batteries, cars and carpets. Attempts to create national programmes for drink containers and electronics (the ''NEPSI process" from 2001-2004) did not come to fruition. But at state level, especially for electronics, there are a number of proposed and operational regulations in place that employ various elements of EPR. For example, California, Maine, Maryland and Washington have either implemented or proposed regulations requiring the collection and recycling of certain categories of WEEE. Although the Californian and Maryland programmes incorporate few or no elements of EPR, the Maine and Washington legal texts have proposed a framework that encourages elements of individual responsibility to be incorporated in any operational programmes that are developed.

Interestingly, New York City has tabled its own law on the take-back and recycling of certain WEEE categories. This sentiment for a fundamental shift in the financial burden of dealing with end-of-life products from municipalities to producers and consumers seems to be gaining momentum in the US, as highlighted by the recent resolution by the San Francisco Board of

[27] Paint refers to leftover paint not used up and returned to HHW depots

[28] For a more complete inventory of Canadian EPR programmes, both mandated and non-mandated, Environment Canada's website on Extended Producer Responsibility and Stewardship located at http://www.ec.gc.ca/epr/en/index.cfm is recommended.

Supervisors that supports state-wide legislation and local initiatives requiring manufacturers to take responsibility for collecting and recycling their products at the end of their useful life.[29]

Battery producers and producers of battery-using products established a nationwide voluntary collection and recycling scheme (with a 70% collection target by 2001) for nickel-cadmium rechargeable batteries in 1994 after certain state governments required producer responsibility for these batteries (Fishbein, 1997; RBRC, 2000).[30] The products covered by the scheme have been expanded to other rechargeable batteries (nickel-metal-hydride, lithium-ion and small sealed lead-acid) (RBRC, 2000). Owing to lower than expected collection rates, in 1998 RBRC postponed the collection goal target to 2004 and subsequently only reported the tonnage of batteries collected (Sheehan and Spiegelman, 2006).

Another voluntary collective response from industry in the United States to enhance recycling was the creation of the Vehicle Recycling Partnership in 1991 to promote and conduct research on technologies to recover, re-use, and dispose of materials from scrap cars (Poston, 1995). Individual companies in the United States have conducted pilot programmes to take-back and recycle large plastic parts that have not been routinely recycled and have made major efforts to incorporate recycled materials into new cars (Davis, 1997).

South America

Argentina has recently proposed a packaging law with elements of EPR at provincial level, however not currently approved or in force. An initiative in Argentina for old batteries was presented in 2003, but is still awaiting enforcement. The province of Buenos Aires has also proposed a battery take-back obligation on producers. In Brazil there are currently binding take-back obligations for used oil, tyres, and pesticide containers.

Several South American countries have begun to draft EPR-based laws for specific EEE product groups. In Brazil, Law 257/99 (CONAMA) makes manufacturers, importers and consumers responsible for the collection and disposal of old batteries containing hazardous substances. It is expected that the manufacturers will have to have proper disposal systems by 2006. Meanwhile, cellular phone operators have started voluntary collection programmes. Similar EPR laws are under development in Chile, Colombia and Venezuela (InfoAmericas, 2005). In this context, it should also be mentioned that MERCOSUR has verbally endorsed EPR and called for its members to implement it for WEEE.

Asia/Pacific

Asia has seen the growing development of EPR programmes for EEE since the late 1990s. Taiwan enforced take-back law for four large home appliances (TV sets, air conditioners, washing machines and refrigerators) in 1998 (Tanaka, 2000), replacing the preceding systems from the early 1990s. In Japan, the Specified Home Appliance Recycling Law, covering the same products as the Taiwanese programme, has been in force since April 2001. Take-back of computers was also fully enforced in October 2003 in a separate regulation. The responses of

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[29] Available at the Product Policy Institute website at http://www.productpolicy.org/assets/resources/SF_Resolution_PASSED_-_EPR_universal_waste.pdf

[30] 8 states (Connecticut, Florida, Iowa, Maine, Maryland, Minnesota, New Jersey and Vermont) have take-back requirements that apply to nickel-cadmium batteries, while Minnesota and New Jersey, aside from requiring manufacturers to take back rechargeable batteries at their own expense, also require that the rechargeable batteries be 1) easily removable from products; 2) labelled with information on the content and method of proper disposal; and 3) banned from the municipal waste stream (Fishbein, 1997).

Japanese producers were to set up two distinct groups to fulfil their responsibilities, Group A and Group B. This provides an interesting case in terms of the potential to provide incentives for manufacturers to change product design to facilitate end-of-life processing. Since each of the leading companies in both groups have invested in recycling infrastructure, a direct information feedback loop to product designers exists.

In addition to Japan and Taiwan, South Korea implemented a deposit-refund system for producers, not consumers, of TV sets, air conditioners, washing machines and refrigerators that was in effect from 1992-2002. Since 2003 it has evolved into a more EPR-like system (Chung & Yoshida, 2006). The ''China RoHS" and China WEEE law, that essentially mimics European Directives of the same name, have as of 1 March 2006 been adopted and are scheduled to come into force on 1 March 2007. Thailand also has a draft law, which was circulated for consultation in summer 2005.

In addition to EEE, Japan introduced an EPR programme for packaging in 1998, whose revision is currently being discussed. A focal point for discussion is to extend producers' responsibility. An EPR programme for cars based on individual responsibility came into force in 2005.

In Australia there are few examples of mandatory EPR programmes in operation. Instead, a voluntary approach to product stewardship is encouraged. At national level, the Department of the Environment and Heritage has encouraged the development of nationwide product programmes for used motor oil, plastic shopping bags, packaging and tyres. The National Packaging Covenant first implemented in 1999 was strengthened in 2005 with increased targets for recycling and diversion from disposal. On EEE, the key electrical and electronic industry associations, the Australian Electrical and Electronic Manufacturers' Association (AEEMA), Consumer Electronic Suppliers' Association (CESA), and Australian Information Industry Association (AIIA) – have recently been developing a voluntary product stewardship initiative called Product Stewardship Australia that will cover TVs. Although most initiatives are voluntary, the State of New South Wales does have a legislative framework that provides the option to deal with priority products through a mandated extended producer responsibility scheme if voluntary initiatives fail to develop.[31]

Similarly, New Zealand has generally encouraged industry to take a voluntary approach to implementing EPR, for example through the 2004 NZ Packaging Accord updated from a previous agreement in 2001. Although identified as priority waste streams, there are no national EPR programmes for tyres, used motor oil, WEEE, diapers or agrochemicals.[32]

[31] http://www.ephc.gov.au/pdf/product_stewardship/ProductStewardship_IndustryDP.pdf

[32] New Zealand Ministry for the Environment: available at http://www.mfe.govt.nz/

Appendix III – EPR Evaluation Tool

Lindhqvist and van Rossem (2005) developed an evaluation tool for EPR programmes on behalf of Environment Canada and the Recycling Council of Ontario, which aimed to provide system operators with a self-evaluation tool to identify the strengths and weaknesses of existing and planned programmes. It was specifically designed to determine how far EPR principles, elements and factors are addressed in designing and operating a programme.

Based on this definition, the evaluation tool is built on two main environmentally-related goals: 1. *Design Improvements of products* and 2. *High use of product and material quality through effective collection and re-use or recycling.* For each of the main goals, a series of questions was provided for system operators or other knowledgeable people to ask themselves. Respondents would be required to pick one of the graded responses (0-3) that best fitted the programme in question. A grade of three denotes that the system being evaluated is considered to have addressed the EPR principles successfully, while zero indicates a very low degree of EPR implementation. Looking at the answers that score the highest grade for each question pertaining to the main programme goals above can provide insights on what would constitute an effective implementation of EPR.

Main Goal 1: Design improvements of products – the EPR system should provide incentives for manufacturers to improve products and systems surrounding their products' life cycles.

Questions:

Q: Will the individual producer directly benefit from product design improvements?

A: The individual producer will benefit financially from design improvements, either at the time of payment or retroactively when costs have been determined following the discarded product's end-of-life treatment

Q: Will individual producers directly benefit from system design improvements?

A: The individual producer will be able to fully realise the financial benefits for such system improvements, when these are implemented.

Q: Will producers collectively benefit from product and system design improvements?

A: All cost reductions achieved by design or system improvements will be transferred to the individual producer or producers collectively and fully influence the costs they have for the EPR system

Main Goal 2: High use of product and material quality through effective collection and re-use or recycling

Sub-Goal A: *Effective collection* – A primary goal in EPR policy is to ensure a high collection rate for the product in question to avoid fly-tipping. A related goal is to divert selected discarded products from the general waste stream to facilitate better treatment and use of the product and its material.

Questions:

Q: Does the system include measures to secure goal achievement for collection targets?

A: Non-achievement of collection targets will undoubtedly be followed by penalties which are generally seen to be less acceptable than the efforts needed to reach targets

Q: Are there tangible incentives in the form of direct or future financial benefits for striving towards higher collection results?

A: Producers receive financial benefits from higher collection rates and these can be substantiated and are perceived as important drivers for producers to strive for higher collection results.

Sub-Goal B: *Environmentally-sound treatment of collected products* – Before being further processed, many products need pre-treatment in the form of dismantling and/or sorting. The aim of this can be to secure special treatment of hazardous components and materials, and to improve the possibilities for re-use and recycling.

Questions:
Q: Does the system provide measures to ensure compliance with the law and other regulations for treating discarded products during collection, sorting, dismantling and treatment?
A: Rules and enforcement system are relevant and largely function well, and only minor improvements have been requested.

Q: Does the system provide incentives to promote Best Environmental Practice for treatment of discarded products during collection, sorting, dismantling and treatment?
A: Measures in this direction will be clearly acknowledged and are promoted by training activities and/or verified by management systems, and are likely to be adopted by most actors.

Sub-Goal C: *High use of products and materials in the form of re-use and recycling* – The EPR implementation should ensure products or their components, when appropriate, can be re-used, and that materials are recovered and used to replace 'virgin' materials, thus saving raw materials and avoiding the environmental impacts resulting from extracting and processing these materials.

Questions:
Q: Is re-use and recycling measured?
A: Results are traced in a fully-transparent way, designed to achieve results as accurate as can reasonably be demanded

Q: Are there measures to secure goal achievement for stated re-use and/or recycling targets?
A: Non-achievement of these targets will undoubtedly be followed by penalties which are generally regarded as less acceptable than measures to reach targets

Q: Are there incentives for striving for high re-use and/or recycling levels?
A: High re-use levels are promoted (in line with technical possibilities for re-use) and financial benefits are likely to exceed costs, and there are tangible financially-related incentives for high-grade recycling of material that cannot reasonably be re-used as products or components.

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