Greening the Economy through Design Incentives

Greening the Economy through Design Incentives: Allocating Extended Producer Responsibility

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I. Introduction

1.1 Background

Despite considerable improvements in some countries, recent statistics suggest that a resource efficient recycling society is still to a large extent an elusive goal.[1] Public authorities continue their quest for policies that would effectively address the depletion of non-renewable materials, reduce emissions to air and water, prevent the creation of waste as well as improve the recycling and end-of-life management of products. In essence, waste management activities need to be moved up the waste hierarchy from sound disposal to recycling, reuse and ultimately prevention.[2] An important instrument in this pursuit remains Extended Producer Responsibility (EPR), through which the private sector can be directly engaged in greening the economy.

Extended producer responsibility as a concept was put forward by academics in the early 1990s. The rational behind EPR is quite simple: by assigning producers the financial and/or physical responsibility for the management of end-of-life products, the producers are led to internalize waste management considerations into their overall product strategies. Rational producers would explore options to minimize the costs of end-of-life management. Alterations in product design and choice of material are amongst the most important means to do so, and are essential to reduce the environmental impact of products. Extended producer responsibility in other words has the potential to generate both economic and political incentives for waste recovery and more broadly, green design.[3] Whether this assumption holds in case waste no longer is a cost, but a profit – a situation that is increasingly faced in certain product groups – is a separate, intriguing question.

The origins of the term Extended Producer Responsibility (EPR) can be traced to a report submitted to the Swedish Ministry of the Environment in 1990, titled "Models for Extended Producer Responsibility".[4] The development of the EPR concept may be viewed in the context of three general trends in environmental law- and policy-making at the time:[5] the prioritization of preventative measures over end-of-pipe approaches; life cycle thinking; and a shift from command and control towards instruments such as economic and informational tools, which leave more flexibility in how the set policy objectives are to be achieved. These three trends merge in the central idea of extended producer responsibility: to create green design incentives for manufacturers.

This article analyzes the core aspect of EPR–the creation of design incentives–today, twenty years since the emergence of the concept. During these twenty years, environmental law- and policy-making has evolved into a more deliberative process that involves multiple levels of governance and networks of stakeholders in fully globalized markets. The article argues that despite the radical changes, the tenet of creating design incentives through EPR can hold. The article analyses the issue of EPR with regard to electrical and electronic equipment (EEE). EEE is perhaps the most prominent area where EPR is being applied today, and the leading piece of legislation in the field, the WEEE Directive[6] of the European Union, has just been comprehensively recast. The analysis will not only offer insights on EPR and its evolution; it also serves more generally as a case for portraying the challenges facing second generation environmental law and policy tools in greening the global economy.

1.2 Purpose and analytical framework of the article

This article discusses the ability of current EPR laws and policy tools to create *appropriate design incentives through changes in responsibility for waste management*. The incentive structure – or rather, the absence of it – has always been an important element of the debate on EPR. Focusing on the problems caused by the potentially absent incentives means that the article will leave out descriptive discussions of other issues

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[1] See the conclusions regarding the EU, the most advanced area in this respect, in e.g. Commission (2011) and Final Report (2010).

[2] The waste management hierarchy is a heuristic that specifies that wastes should be managed according to a set of priorities: reduction, reuse, recycling and finally disposal. The European Union has adopted the hierarchy as a principle for the management of wastes (Waste Framework Directive 2008/98/EC, recital 1 and Art 4).

[3] Lifset (1993).

[4] Lindhqvist & Lidgren (1990).

[5] Tojo (2004).

[6] The original law, "Directive 2002/96/EC of the European Parliament and of the Council on Waste Electrical and Electronic Equipment" is in this paper referred to as the "WEEE Directive". When the new revised law or its provisions are distinguished from the original law, they are referred to as "Directive 2012/19/EU of the European Parliament and of the Council on Waste Electrical and Electronic Equipment (WEEE) (recast)" or the "Recast WEEE Directive".

related to EPR. While interesting, they are not where the shoe really pinches in waste takeback[7] policies today. The fundamental issue is the design incentives. Without the incentives, the core rationale for EPR is lost.[8]

This narrative proceeds on four fronts in discussing the (missing) incentive structures pursued through EPR. First, the article attempts to clarify certain key concepts relating to EPR. The concepts have evolved and sometimes become blurred during the practical implementation of EPR. In parallel with the conceptual analysis, the article will secondly analyze, in a qualitative fashion, issues which today appear to constitute the most prominent challenges to creating product design incentives through EPR. These are core issues that risk collapsing the broader EPR system[9] or severely impede it from functioning. They should therefore be at the top of the policy debate and agenda. Third, this article seeks solutions and remedies to such challenges to design incentives. It does so by making use of more than ten years of practical experience that has accumulated in EPR policies in the European Union (EU), the U.S. and Japan. Fourth, the article attempts to systemize the EPR discourse by developing a multi-level governance based framework of analysis.

The research has been pursued along two themes: the *allocation* of extended responsibility *amongst* the producers, on the one hand, and the *scope of the producers' responsibility* vis-à-vis the role of stakeholders other than the producer itself, on the other. The challenges to creating design incentives through EPR may be grouped under the two themes in roughly the following fashion:

1. How should the responsibilities be allocated amongst individual producers?
   - 1.1 Should each producer be individually responsible for the waste from its own products, only, or should the producers rather be collectively responsible for waste from all similar products?
   - 1.2 Should a producer be responsible for treating waste of similar products of o ther producers that no longer exist on the market, or should other ways be created to deal with such "orphan" products?
   - 1.3 Should the producer have both financial and operational (functional) responsibility for waste?
   - 1.4 Should the producer be responsible only for waste from products put on the market after the legal requirements were put into place ("new waste") or also for those preceding the regulations ("historical waste")?
2. What should fall within the scope of a producer's responsibility?
   - 2.1 What exactly should the *producers* be and not be responsible for?
   - 2.2 What kind of (ancillary) responsibilities should be allocated to other stakeholders

These two themes are obviously interlinked and partly overlapping. Similar conceptual and practical challenges arise in both. To allow enough detail in the analysis, however, this article focuses on key issues under the first theme, only: the allocation of responsibilities *among* the producers. The issues regarding scope of the producer's responsibility are discussed in a companion article elsewhere.[10]

As mentioned, the article proposes to take a new, more *systematic approach* to analyzing EPR. Although there is increasing research conducted on EPR and its shortcomings, the scholarship often either focuses on isolated issues, or gives an overview without a clear structure. In particular, it seems that the current concepts and debate around the shortcomings of EPR fail to take into account that the issues may relate to three distinctive levels:

- the general, conceptual level
- the multiple levels of governance in policy making
  - international/federal level
  - the (Member) State level
  - the municipal level and
- the level of takeback solutions in practice

By describing the key concepts and framing the various challenges to EPR against three levels provides more a more systematic and accurate analysis: what exactly are the issues under discussion? Where are the root causes of the problems? Who are the parties directly involved and affected? A systematic approach is also helpful in finding appropriate solutions. It delineates who are the parties that hold the power to decide on a particular matter. This does not imply that the levels exist in isolation from one another; there is considerable interaction.

Highest up in this hierarchy of levels of analysis are the theoretical and conceptual foundations of the EPR. They frame the discussion on the matter on a general level and independent of the applicable policy context.

The second level is that of policy-making, which itself can be further divided onto the multiple levels of governance. The highest level of governance consists of the international/federal[11] laws and policies. In this

[7] Takeback refers to policies that require producers to take back their products at the end of life (EOL).

[8] Lindhqvist & Lifset (2003).

[9] "IPR system" refers to takeback and recovery systems designed to permit or enhance the possibility of IPR.

[10] Greening the economy through design incentives: what roles for which stakeholders in the context of Extended Producer Responsibility?

[11] International and federal laws share the basic characteristic of overarching and/or harmonizing laws in a set of potentially diverging lower-level jurisdictions such as Member states (EU), states (e.g., U.S., Australia) and provinces (e.g., Canada). Although there are obvious differences between international and federal laws in the strict senses of the terms, for the purposes of this analysis they may be treated together.

article, the EU's WEEE Directive is the principal case study-like point of reference. The European Union therefore constitutes the international/federal level of analysis. The WEEE Directive can be considered a pioneering piece of EPR legislation, both for its environmental and economic implications. It has affected business around the globe, and provided a model for many other jurisdictions in the world. The developments in Europe still constitute much of the doctrinal frontlines today, and are as said very topical also due to the just completed recasting of the WEEE Directive at the time of writing this article (summer 2012).[12]

Under the international/federal level are the (Member) state laws and policies. This level of governance includes the *transposition* of supranational law into (Member) State laws, as well as the practical *implementation* and *enforcement* activities of public authorities. Lackluster state enforcement activities have often been cited as a fundamental problem for European WEEE policy. The third level of analysis contains also issues that are specific to federal structures, such as the European Union (EU) and the United States (US). In the EU, directives (such as the WEEE Directive) are a form of European law that only set the result that the Member States are to reach. The Member States retain the discretion of choosing the most appropriate means of achieving the results of the WEEE Directive while transposing it into their national laws. The Member State transposition should not lead to any disparities that could undermine the harmonizing objectives of the Directive. Differences in national WEEE policies could hamper the effectiveness of recycling policies.[13] However, the way in which the EU Member States have transposed the WEEE Directive into national law has been criticized. This applies in particular to *Individual* (extended) Producer Responsibility (IPR), according to which each producer is responsible individually for its own products.[14]

The third level of analysis covers the practical aspects of takeback and recycling systems. They could admittedly also be considered a part of the second level, i.e., the governance structures. The collection in many of the takeback systems has in practice been set up by the municipalities, for example. In fact, the concept "governance" expands the classic notion of government by encompassing also issues that relate to the role and decisions of the *non*governmental parties. The role of nongovernmental parties, such as producer responsibility organizations[15] (PROs) and groups of individual stakeholders (producers, retailers, consumers) in the governance structures of EPR is central, in particular at this lowest level of arranging EPR in practice. The issues that arise in the practical implementation of takeback and recycling policies are fundamental to design incentives, and are therefore in this article dealt with as a separate, third level of analysis.

This article also aims at contributing to the EPR debate by challenging the viewpoint of many policy-makers, stakeholders and academics who think that while EPR may make for attractive theory, it is unworkable in practice. This myth is challenged by providing a description of real-life examples and solutions on such issues. In the complicated reality of EPR, the devil often *is* in the details. There is an abundance of confounding variables that deserve to be better understood.[16] Capsule summaries of the practical cases studied in this article are introduced in Annex I.

In terms of methodology, this article juxtaposes the three levels of analysis against what were above identified as the two themes comprising the most prominent issues regarding the design incentive structures of EPR: the allocation of responsibilities among producers and the scope of producers' responsibility. Together they form a matrix, which serves as the analytical framework of this article. The framework is illustrated in table 1. The left column in the table summarizes the theme and issues dealt with in more detail later in this article, while the theme and issues in the right column are analyzed in a companion publication.[17] As noted, many of the issues exist in some form on more than one level of analysis and under both themes. Rather than showing issues in multiple cells, the table illustrates how the article analyses each issue in its most prominent context. The respective Section numbers of this article are indicated inside the parentheses.

This matrix is intended to provide a systematic overview of issues currently affecting the functioning of EPR systems. There is clearly more than one way to fill in the matrix, but a systemization will help in examining problems and alternatives with different

[12] Recast WEEE Directive. That being said, recent examples from the United States as well as Japan are also made use of in this paper (see further below).

[13] WEEE Directive, recital 7, Member States legislating individually on producer responsibility "may lead to substantial disparities in the financial burden of the economic operators. Having different National policies on the management of WEEE hampers the effectiveness of recycling policies. For that reason the essential criteria should be laid down at Community level".

[14] See Section 2.2 below. Van Rossem, Tojo & Lindhqvist (2006).

[15] PROs are entities that have been set up by producers to fulfill their legal responsibilities at the national, state or provincial levels. In many formulations of EPR legislation, there may even be an explicit provision for producer's individual responsibility to be delegated to a body, which collectively assumes individual responsibilities on behalf of its members (OECD, 2001). As of 2007, there were 260 PROs in the EU (Mayers 2007, 115).

[16] Atasu & Van Wassenhove (2011).

[17] See footnote 10.

Table 1. The analytical framework – a summary of the issues, each in its most prominent context. Individual issues and terminology are further elaborated in the Sections indicated by the numbers.

Themes Level of analysis	Allocation of responsibilities amongst producers*	The scope of producers' responsibility**
Conceptual	– Operational (physical) v. financial responsibility (2.1) – Responsibility v. the means to fulfill it (2.1.2) – Delegation of responsibility (2.1.3) – Individual v. collective responsibility (2.2)	– Notion of shared responsibility – Matching rights and responsibilities
Policy making		
International/federal	– Retroactive responisibility (historic v. new waste) (3.1.3) – Orphan products and free riders (3.1.4) – Recycling guarantees (3.1.5, 3.2.2) – Visible fees (3.1.6)	– WEEE escapes producers' schemes – Cherry picking by third parties – Lacking consumer engagement – The notion of 'producer'
(Member) State	– Favouring collective over individual takeback schemes (3.2.1)	– The producer definition revisited – Rights and responsibilities revisited
Municipal	– Collection schemes (3.3)	– Linking public and private collection schemes
Practical system	– Takeback schemes neglect DfE efforts (4.1) – Lack of competition between PROs (4.1) – The shredder economy (4.2)	– The shredder economy – Lack of knowledge on WEEE streams – Contextual nature of takeback solutions – Exports to developing countries

* Addressed in this article
** Addressed in companion article

approaches for EPR in terms of their ability to provide incentives towards design for environment (DfE[18]).

II. EPR on the Conceptual Level

A broad, though not universal agreement exists today on the definition of extended producer responsibility (EPR):[19] EPR means the internalization of waste management considerations into overall product strategies by making the producer responsible for its products in the end of the product's life cycle.[20] It is more controversial, however, what exactly the notion of "responsibility" in the definition should entail. Does Extended Producer *Responsibility* as a matter of principle cover all kinds of responsibility, including *operational and financial* responsibility?[21] Is each producer *individually* responsible, or does EPR establish some type of *collective* responsibility? Can a producer be made responsible for a product that it has not produced, and therefore has no knowledge or control of? The precise contours of the responsibility are central to the incentive structures of EPR. These are thus fundamental questions on a conceptual level, common to all producer responsibility systems.

2.1 Operational v. financial responsibility

Operational responsibility defines a party's operational (i.e. functional) responsibility for the completion of

[18] Design for environment (DfE), also called eco-design, refers to the design of products in a way that reduces the negative impacts of the product on the environment throughout the product's life-cycle.

[19] Some researchers and policy advocates argue that EPR is a policy principle and not a policy strategy. See Davis (1994) and Lindhqvist (2000, 153-157).

[20] Lifset, 1993. There is also debate today over whether the EPR today also encompasses upstream issues See Lindhqvist's history of the evolution of the concept of EPR (2000, 29-56).

[21] See also Lindhqvist (1992), who also proposes a third type of responsibility: informational. It would appear however, that informational responsibility could also be considered a sub-category of operational responsibility, i.e. responsibility for the action of collecting and distributing information.

specific EPR related activities. For example, the Finnish Government Decree (852/2004) on WEEE requires[22] that "[p]roducers shall *organize treatment* of separately collected waste electrical and electronic equipment at a facility that has an environmental permit".

The *financial* element of producer responsibility on the other hand defines how the economic burdens incurred in fulfilling the waste management operations are to be borne.[23] The above-noted Finnish Decree specifies[24] that producers engaged in distance selling through the Internet or catalog retailing, for example, shall participate in the financing of the management of waste electrical and electronic equipment from private households. Placing the financial responsibility on the producer (or other stakeholder) creates an incentive for it to minimize the ensuing costs and, in many cases, the environmental impacts. This idea is at the core of extended producer responsibility.

2.1.1 *Asymmetric operational and financial responsibilities*

The operational and financial responsibilities are often identical in scope: the operational activity imposes costs on the party that executes them. This is not always the case, however: an electronics producer might also be charged with the financial burden of, for instance, operating municipal collection sites for waste electronics, even if a municipal waste authority were to bear the functional responsibility for their operation.[25] The reason for distinguishing operational and financial responsibilities conceptually from one another links to the fundamental environmental principles that underlie EPR: the polluter pays principle and eco-efficiency.[26] The allocation of costs for waste electronics could, according to the polluter pays principle, be laid on the producer as one of the "polluters" in terms of WEEE.[27] Other WEEE polluters can be identified as well, however, and the most eco-efficient execution of a specific task, such as the collection of waste from private households, in some cases necessitates the involvement of a *different* party, such as a municipality with a functioning waste collection system.[28]

On the other hand, the operational and financial responsibilities are in practice usually identical, unless there are offsetting arguments to separate them. Otherwise, the link between the charges paid and the costs of specific tasks may quickly grow thin. One may end up simply setting arbitrary mandatory financial charges on producers (and other stakeholders) for the unspecified operational activities of third parties, in particular public authorities, which the producers can neither monitor nor manage. An example could be to charge the municipalities with the responsibility to collect WEEE from end users, but require the producers or other stakeholders to pay for such collection. This kind of charges can be interpreted as a general tax, rather than an economic incentive. The design-for-recycling incentives of a producer in the role of a tax payer are obviously much weaker than where it (or any other stakeholder) is directly incentivized by holding it directly responsible for, and giving it the full control of, its *own* costs and activities.

It therefore appears that the incentive structures of EPR cannot be fully created or maintained if the different stakeholders are not made directly financially responsible for the EOL activities that they conduct and/or if the financial and operational responsibilities are separated in obscure ways. The responsibilities to act and to pay should be thought through very carefully in all cases, otherwise there is a risk of completely collapsing the incentive structure of EPR.

2.1.2 *Confusing operational responsibility with the means to fulfill it*

The party charged in law with a particular operational responsibility (such as the organization of the collection of WEEE) may contractually delegate the actual execution of the task to fulfil the responsibility to a third party. The producer could subcontract a logistics company, for example, to, in practice, organize the entire waste collection process for the producer.[29]

The conceptual distinction between the legal obligation to have operational responsibility for the management of waste (in our example, that of the producer) and the physical acts in fulfilment of such responsibility (in our case that of the waste collection company) has been a source of confusion. It is essential from the viewpoint of incentives and system efficiencies to allow the producer (and other parties) that have the responsibility to make full use of all the flexibilities and waste management expertise that a delegation of necessary operations to third parties may offer. Such delegation will obviously not release the delegating party from the final, legal obligation to perform the tasks.[30] It is in other words the producer

[22] Section 7(1) (emphasis added).
[23] Kalimo (2004, 205-7; 2006 456-7); van Rossem (2008, 21-3).
[24] Section 9 (emphasis added).
[25] Reina (1999).
[26] A common reference for the term eco-efficiency is the World Business Council for Sustainable Development (WBCSD (1992)), which defines it as "competitively priced goods and services that satisfy human needs and bring quality of life while progressively reducing environmental impacts of goods and resource intensity throughout the entire life-cycle to a level at least in line with the Earth's estimated carrying capacity." Huppes and Ishikawa (2005) provide a detailed analysis of the concept.
[27] For a discussion on applying the polluter pays principle on WEEE, see e.g. Kalimo (2006, 457-60).
[28] For further discussion on the "external" division of responsibilities between different stakeholder groups in EPR, see the companion paper in footnote 10.
[29] Huisman *et al.* (2006).
[30] Kalimo (2004, 205-6; 2006, 456); van Rossem (2008, 21-3).

that remains the responsible party towards the authorities for the end-of-life management of WEEE, not for example the logistics company to whom a specific task may have been subcontracted.[31] If the party with the operational responsibility can delegate the actual execution of the tasks to third parties, the need to separate financial and operational responsibilities from one another on the grounds of eco-efficiency (see previous section) is reduced. It is important for the producer and for DfE that the producer maintains full control of the delegated activities and their costs. Should the costs rise, it can[32] renegotiate, reclaim the execution of the activities to itself or delegate them to a more competitive third party, just as in any business transaction.

2.1.3 Delegating financial responsibility?

Would it also be possible, conceptually or practically, to talk about *delegation* in terms of the *financial* producer responsibility? This appears doubtful, and is more complicated an issue than the delegation of practical tasks to fulfil the *operational* responsibility. Shifting (a part of) the cost of EPR activities into the product price by raising it by a similar amount might perhaps be considered by some as a delegation of (a part of) of the financial burden from the producer to the consumer. As with the operational responsibility, the final responsibility to ensure that the legally specified tasks are fulfilled remains on the delegating producer. But would such a shift of costs for "others to pay" be in accordance with the letter of law, and with Extended Producer Responsibility?[33] The questions are pertinent in particular where the producer is able to offset the additional cost of waste entirely. Is there then still an incentive to behave in a more environmentally sound manner?

The integration of the full cost of taking back WEEE in a product's sales price might be argued by some to be against the spirit of the producers' obligations that stem from the WEEE directive and the transposing national acts. It is the *producer* that is defined in the legal text as the party charged with the financial responsibility.[34] A producer will also not take great efforts to minimize costs that he is in any event able to shift to another party to carry. These claims do not seem to hold, however.

A more convincing way to argue is that the incidence of payment rarely really reflects which party actually bears the costs. In this sense the way in which the producer ultimately may be able to fill the responsibility is not relevant. Stylized economic models[35] indeed would anticipate that producers will attempt to protect erosion of profit margins by passing on costs to consumers either within prices or as a separate charge. Regardless of who is held responsible for the financing of waste electronics, the costs will be reflected on both the producers and the consumers somehow.[36] It would also seem overwhelming in practice to try to control the ways in which companies might determine product prices in relation to waste management costs arising from the introduction of EPR.

In a competitive market, producers and retailers may choose not to increase prices and instead maintain pre-existing prices for the fear of losing sales (and therefore most likely reduce their profit margins). This does not imply, however, that the company would necessarily operate at a loss. And regardless whether the market is competitive or not, lowering the actual cost incurred by the producer will obviously make the business more profitable. In both cases, whether a producer absorbs EPR costs and holds its prices constant or raises its price to cover these new costs, there is an incentive to drive down the actual cost of recycling, because the consumer finds the life cycle costs[37] to be less. From an environmental perspective this does not appear problematic as such.

Most important, however, is the argument that the internalisation of costs is supposed to increase costs to consumer. Those products not well designed for end-of-life (EOL) will become more expensive, and are therefore set to lose market share against products with lower end-of-life costs. A competitive market place–assuming one exists–should protect the consumer from being overcharged. The core issue is ultimately whether or not economic incentives for green design are created, not whether producers choose to absorb costs associated with EPR into their profit margins or to raise prices.

In reality, the impact of recycling costs and product pricing may not be easy to predict. Consumers may not associate recycling fees with the product price, and their purchasing behavior may not be influenced by their specific perception of recycling fees. i.e. demand for a product may be inelastic relative to changes in recycling costs. In situations where product demand is

[31] Obviously, the delegated party will usually have numerous other legally or contractually defined obligations of its own to fulfill.

[32] Within the limits of the provisions of the contract between him and the logistics company.

[33] See footnote 9.

[34] WEEE Directive, Article 8; Recast WEEE Directive, Article 12.

[35] See e.g., Atasu *et al.*, (2009).

[36] Atasu & Van Wassenhove (2011, 19-20). More specifically, price sensitive linear demand models would indicate that the producers reflect part of their recycling costs to the consumers. If the consumer becomes responsible, the producer would in turn assume part of the consumers' recycling costs by reducing the price of the product. The financial obligation choice may therefore not significantly affect welfare in stylized economic models.

[37] Life cycle costs of electronic equipment are sometimes called "full cost of ownership" in the electronics and computer industries.

inelastic to product prices, and the cost of recycling is passed fully on to consumer through increased prices or fees, producers may then not find incentives to improve the greenness of their products or make their recycling easier. The consumer perception of recycling fees and resulting producer behaviour may be a real issue for the economic efficiency of electronics take-back. A detailed empirical investigation seems necessary to guide legislation in support of EPR, and WEEE takeback more generally.[38]

Issues relating to the delegation of the financial responsibility may be observed in the Japanese WEEE takeback law, "Specified Home Appliances Recycling Law" "SHARL",[39] for example. In SHARL, the final consumers, finance both the collection and recycling of WEEE. The financing takes place through an end-of-life fee that is charged at the time of disposal. Separate fees are collected by retailers for the collection and by the producers for recycling. The fees are managed through a recycling ticket centre that logs the movements of all individual waste items in the recovery system.

The producers have formed two consortia ("Group A" and "Group B") to fulfil their responsibilities in SHARL. The Groups have set the fee to cover the costs of *recycling* at the same level, while the actual costs of recycling will depend on each Group's efficiency. In contrast, the prices charged to the consumer for *collection* vary considerably, depending mostly on the size of the retailer.

A modest economic incentive and an element of competition are hence built into the systems. It does not appear clear, however, how the ensuing economic benefits or costs will be divided between the producer, the consumers and other stakeholders. In order to establish proper incentive structures to better design the products for the environment, the producers should be entitled to reap an adequate part of any resulting savings.

Finally, by placing the financial responsibility on a central actor, the producer, the burden of managing WEEE is redistributed between the stakeholders in the value chain. The outcomes of this type of a "delegation" will depend on the market structures, the negotiation positions and the behaviour patterns of the parties. The negotiation positions or current behaviour of the parties, however, may not result in the most equitable or efficient solution. This is so in particular when a single party in the system is in practice and/or through poorly balanced legal provisions placed in a disproportionately strong position. For example the Belgian WEEE takeback system, organized by a single the takeback organization (PRO) Recupel, has been criticized for unjustifiably high fees on the consumers, in particular during the first years of its operation.[40] The existence of competing PROs, such as the collaborative ERP (European Recycling Platform) could alleviate these kinds of problems.

2.2 Individual v. collective responsibility

From the perspective of incentives for improved design, probably the most fundamental aspect of the extended producer responsibility is the distinction between *individual* and *collective* responsibility. As noted, responsibility is individual, when it is determined for each producer individually and only applies to the products of the producer in question. A collective responsibility is allocated on producers as a group, traditionally without distinguishing between the products of individual producers. The question thus deals with the division of responsibilities *amongst* the various producers, rather than between producers and other stakeholders, or between operational and financial responsibility. In other words, both the financial and operational responsibilities, which were the issue in the previous section 2.1, can be organized individually or collectively between the producers.[41]

Indeed, the distinction between individual and collective responsibility has been a focal point in the EPR debates for more than a decade, because it is directly linked with the objective of creating design incentives. The original definitions of EPR by Lindhqvist and Lifset built upon the vision of individual responsibility, albeit the authors did not explicitly put forth the individual aspect.[42] It does appear common sense that the incentives of a producer to improve its products are present where its responsibility covers its own products rather than the products of the industry group to which it belongs. Regardless of whether *individual* producer responsibility (IPR[43]) was part of the original concept of EPR or a later refinement of it,[44] IPR may thus be understood as the creation of appropriate incentives for producers to properly manage their end-of-life products by allocating responsibility separately to each producer on the basis of (only) *its* actions and (only) *its* end-of-life products, but not those of other producers. This view of IPR implies that design incentives cannot be properly created through producer responsibility, if costs on producers, will affect them all in a uniform way. The analysis assumes that

[38] Atasu & Van Wassenhove (2011, 19-20).
[39] See Annex I for further information on the law and the schemes established to fulfill set requirements.
[40] Mayers (2010).
[41] So, for example, producers may co-operate collectively to organize collection and recycling, and their financial responsibility maybe be calculated individually in relation to the share of each of their products collected.
[42] Lindhqvist and Lidgren (1990); Lindhqvist (1992); Lifset (1993); Lindhqvist & Lifset (2003). For early critical views on individual producer responsibility, see e.g. Stevels (2001).
[43] The term IPR refers throughout this paper to individual producer responsibility, not to the (as such more established) concept of intellectual property rights.
[44] Mayers *et al.* (forthcoming).

EOL waste is indeed a cost rather than has a positive value.

Collective producer responsibility, on the other hand, requires that all producers of a particular type of EE devices are jointly responsible for the WEEE. Collective responsibility, just as individual responsibility, can be of an operational and financial type. Collective financial responsibility means that the aggregate cost of all collected waste is shared amongst all the producers in the sector. The individual producers' shares of the aggregate cost then need to be apportioned between the producers in some fashion.

The main strengths of collective responsibility have been associated with the practical simplicity and scale economies of its *implementation*: treating producers of particular devices as a group has in many instances been thought to obviate the need to, for example, separate streams of collected waste into accurately targeted fractions per company. The matter is discussed further in Sections 3.1.2 and 5 below. The lack of direct connection between a *single* producer and its actions has in collective systems so far had the fundamental shortcoming of diluting or entirely removing proper incentives to design for the environment. In addition, as mentioned above, it is incorrect to assume that individual responsibility could not be implemented through collaborative ("collective") operation of WEEE takeback systems.

The debate over individual versus collective responsibility has fundamentally revolved around the trade offs between properly targeted incentives on companies to behave environmentally, on the one hand, and the complexities and feasibility of creating such incentive structures in practice, on the other. The trade offs are not black and white, either. Producer responsibility systems consist of a number of elements, and these elements have varying degrees of individuality or collectivity. The combinations of the elements in an overall system therefore lead to varying overall tradeoffs. It is exactly these characteristics of the overall system that the policy makers and stakeholders assess in their search for optimal takeback solutions.

The different elements of producer responsibility are also the main issue in this article. Having introduced the issue at a conceptual level in this chapter, the ensuing chapters address the challenges and solutions at different levels of governance, and in the practical implementation of IPR. The quest remains unaltered: to optimize design incentives while minimizing or entirely avoiding the negative trade-offs of complexity and unfeasibility.

III. EPR on the Multiple Levels of Policy Making

3.1 EPR at the supranational level: the case of WEEE Directive

3.1.1 The political economy of producer responsibility

This chapter discusses challenges to design incentives that have arisen specifically on the supra-national level of policy making. European countries have been pioneers in applying EPR in environmental policy in areas such as packaging, motor vehicles and waste electrical and electronic equipment (WEEE). The harmonization of producer responsibility in the WEEE Directive at the level of the EU was envisaged not only to enhance the protection of the environment, however; it was also closely connected to the Union's internal market philosophy.[45] Producers in different Member States should be able to compete under equal conditions. The WEEE requirements should be similar across the EU, and not affect any single party unjustifiably or inequitably. Producers active on the EU market should in a similar fashion need to internalize the environmental costs of their activities. Moreover, a wide application of EPR forces EEE companies to compete, which creates further incentives to innovate so as to reduce costs.

The level-playing field approach of the Directive does and should therefore *not* mean that the costs to all producers are to be evened out, quite the contrary. The WEEE Directive nevertheless introduces such an evening-out of costs, in certain respects: it establishes collective financial responsibility for "historical" ("old") waste (i.e. waste from products put on the market before the WEEE Directive came in force on 13 August 2005). A collective responsibility tends to level out the costs. "New" waste (i.e. waste from products put on the market after the above date) is subjected to individual producer responsibility: each producer is responsible for financing the treatment and recycling of WEEE from its own products, only. This division was a part of the political compromise struck at the EU level at the time of enactment. The European co-deciding legislators, the European Parliament and the Council, had diverging views on new waste: almost all Members of the European Parliament preferred an individual responsibility for new waste, while most Member States in the Council supported a collective responsibility. The controversy left its traces in the final text of the WEEE Directive, and the Council's reluctance to accept IPR was a prelude to the poor implementation of the directive into national law in EU Member States.[46]

[45] See e.g. Recital 8 of the (original) Directive.
[46] Van Rossem, Tojo & Lindhqvist (2006).

The legislative outcome at the EU level regarding responsibility for historic WEEE can be partly explained by the fact that EEE producers have diverging preferences regarding the individual or collective nature of producer responsibility. More generally speaking, two kinds of producers tend to lose out in a takeback and recovery system based on individual responsibility. First, producers that are environmentally inefficient (e.g., whose products are more expensive to recycle) will face higher costs than their more efficient competitors. This is, of course, the crux of IPR. Second, producers who have a heavy "historical" burden from products sold earlier, particularly in cases where their market shares have subsequently diminished, could result in them paying a disproportionately large cost for returning waste in comparison to their current sales. These two types of producers therefore tend to resist the idea of individual producer responsibility–the former of course for particularly poorly defensible reasons.

3.1.2 Further clarifying the distinction between individual and collective producer responsibility – a tort law analogy

The analysis may here be shifted for a moment in a bit more detail to the legal concepts individual and collective financial responsibility. The distinguishing characteristic between the two appears to have become that in collective responsibility, there is no direct link between the *actual* end of life cost of a *particular* product or brand, and its producer. Only a proxy of some sort, such as current market shares, is used. This may be a problem, however: a proxy is unlikely to accurately reflect each party's liability for the created waste and may therefore lead to an inaccurate and unrepresentative division of costs.[47] Tort law[48] may offer useful analogies on the apportionment of liabilities between the responsible parties, because it is the basic framework in most legal systems for dealing with questions of harm, fault and the ensuing responsibility. The (contested) question of the extent to which the producers' activities regarding (W)EEE fulfill the description of harm or injury in accordance with tort law is left aside here. The analogies sought after here only relate to the *allocation* of an established responsibility and liability.

In the case of, for example, car accidents or soil degradation, the responsibilities of the liable parties are usually apportioned on the basis of factual findings of fault.[49] Soil degradation cases may even involve issues of retroactivity.[50] *Ex analogia* for WEEE, the apportioning would be most accurate in terms of the parties' liability if it were based on the actual costs per product or brand. Following a reasoning analogous to general tort law, the apportionment *should* rely on actual costs of end of life management. That represents the most accurate division of the parties' liability. Only if such a division cannot be established,[51] or if it proves unfair or unjustified, are other grounds such as market share to be used as a second step for the purposes of apportionment. Yet it appears that today the second step, the market share approach, is taken from the outset as the presumption in apportioning collective responsibility, without first considering the actual costs of each producer. This may create the false impression that each producer's actual costs *could not* and *should not* be determined in cases of collective responsibility. Such a false impression is problematic for individual responsibility schemes, because it gives collective schemes a(n unfair) competitive advantage of simplicity and ease. The predominance of market share based systems also seems to falsely equate a market share allocation with collective responsibility. The confusion has shifted the focus away from what collectivity in responsibility really means onto how the responsible parties' shares of such collective responsibility are to be allocated.

To be sure, there does exist an important difference between individual and collective responsibility–but it is on the *limits* of the allocated responsibility, not on its apportionment. Responsibility that in law is charged separately on individual producers for their own branded products, only, *limits* the producers' responsibility for financing any *other* products. In terms of tort law, individual responsibility would be analogous to several liability.[52] Collective financial responsibility in contrast is defined top-down, creating a responsibility for the aggregate cost of *all* end of life products as a starting point before allocating the shares. If the responsibility were *joint and several* responsibility (in civil law countries the term *solidary* responsibility is often used), each producer would not only be responsible for its share of the aggregate cost, but could also *prima facie*[53] be alone held financially responsible for the cost of *all* end-of-life products. In the latter case, the producer obtains a right of recourse

[47] Mayers *et al.* (forthcoming).

[48] The term tort law is used here in the wide sense. In the civil law countries, law of delicts, or liability law are rough equivalents. Bell & McGillivray (2008, 563-76).

[49] Or entirely without findings of fault, i.e. in accordance with strict responsibility.

[50] See e.g the U.S. CERCLA (1980) as amended bu SARA (1984), which retroactively established liabilities on a wide variety of involved stakeholders to clean-up landfill sites.

[51] Van Gerven, Lever & Larouche (2000, 447-8 and 451), annotating the Dutch case HR 9 October1992; Deakin (2003, 253-4, 855)

[52] Several liability means the liability that is separate and distinct from another's liability, so that the plaintiff can bring a separate action against one defendant without joining the other liable parties (Black's law Dictionary 1999, 926).

[53] On first examination. The responsible party obtains a right of recourse towards the other jointly and severally responsible parties.

to retroactively claim back the shares of other producers. The explicit reference in the WEEE Directive to "proportionate shares" of the costs for the collective responsibility for historical waste would sensibly seem to exclude joint and several type responsibility, however. There are considered to be several responsible actors, analogous in tort law to concurrent tortfeasors, who, acting independently of each other, in combination have caused damage.[54]

The differences in the scope of responsibility are important when the waste management systems deal with end-of-life products, whose owners can*not* be identified or found. Under an IPR system, a producer could not be made responsible for orphan products. Further, it could potentially be claimed that if (the cost of) a particular manufacturer's own products cannot be determined in the system, no *individual* responsibility for such waste can be allocated, either. There might hence in fact be, from the perspective of the scope of the responsibility, a lacuna in the current WEEE Directive.

3.1.3 Establishing a retroactive responsibility for WEEE

The extension of producer responsibility temporally backwards to historical waste (from products sold before the legislation was enacted) creates a retroactive responsibility. A retroactive responsibility – the regulation of actions taken before the legal requirement is set – is problematic from the perspective of legalism.[55] It may severely reduce legal certainty, legitimate expectations and equality.[56] Retroactive environmental legislation is therefore possible only in exceptional cases where "the *purpose* to be achieved so demands and where the *legitimate expectations* of those concerned are duly respected".[57] Whether these conditions were met in the case of the WEEE Directive is beyond the scope of this article.[58]

From the perspective of the present analysis, the main issue is the (missing) link to the *design incentive logic of EPR*: there is regrettably little one can do about the past. Of course, some producers may have been far-sighted and produced goods with environmentally superior qualities already over a longer term. In theory, they may even have internalized the incurred and expected environmental costs of the products in the product prices. In practice, however, producers will not have addressed end of life management of their products and thereby internalized their environmental impacts voluntarily. In the absence of legal requirements, the end of life characteristics and costs of products do not tend to be predominantly driven by environmental considerations. The market economy rather emphasises short term (quarterly) profitability and other factors such as key product features.

One option in the formulation of the WEEE Directive would have been to place the responsibility for historical waste electronics on the society at large in the form of a supplementary waste tax,[59] for example. As will be seen below, this actually would seem like the preferred option in many instances. The European legislature however has chosen to maintain producers, who (as a group) were considered key polluters and who had also financially benefited from the products that now constituted the problematic historical WEEE, as the collectively responsible parties.[60] The share of burden for historical waste per company may according to the WEEE Directive be determined on the basis of, for example, current market shares by type of equipment.[61]

3.1.3.1 Actual costs v. current market shares

A key advantage according to the proponents of collective responsibility for *historical* waste was twofold.[62] First–when allocated on the basis of current market shares–it would potentially distort the current competitive positions of companies less than would individual responsibility. Companies with a large market share would finance an equally large proportion of the historic waste. Fluctuations in market shares over time would thus not be taken into account, because companies' ability to carry their responsibility is, according to the argumentation, better reflected by their *current* market positions than their past sales. Adding to the argument for collective responsibility using market share allocation, under IPR a producer could even be declared technically bankrupt, should

[54] Deakin (2003, 850-51, 855).

[55] The principle of legalism emphasizes the importance of law or formulated rules. It implies that obligations set on individuals are to be based on positive law, actually and specifically enacted or adopted by proper authority for the government of an organized jural society, and thus distinct from moral or ideal law, or from arbitrariness. (Black's Law Dictionary 2009). The obligations therefore need to exist at the time an act is committed.

[56] Kalimo (2006, 497). See, e.g., Case 100/63 *J.G. van der Veen*; Case 17/67 *Firma Max Neumann*; Case 21/81 *Criminal proceedings against Daniël Bout*.

[57] Case 98/78 *Racke* (emphasis added).

[58] On retroactive EU legislation, see e.g. Case 10/85 *Milac*; Case C-368/89 *Crispoltoni*; Case 13/92 to 16/92 *Driessen*.

[59] Environmental taxes are procedurally never an easy option in the EU, however, as they require unanimity decision making in the Council.

[60] Article 8(3), WEEE Directive; Article 12(4), Recast WEEE Directive.

[61] Kalimo (2004, 223-5; 2006, 497-500). In other words, a *market share based financing* means that producers pay for the treatment costs of all collected WEEE within the sector in proportion to their market share of EEE products sold at the time of recycling. The financing may also be based on a *return-share model*. Here, compliance fees are levied on the producer on the basis of the calculated share of its units that are returned through the collection system. (See further in Chapter 4).

[62] See, e.g., Stevels (2001).

the entire volume of its potentially massive historical waste turn in accounting into a liability overnight. These are, in principle, the kinds of considerations of fairness and justice that were mentioned above, to be used in case more accurate apportionment on the basis of actual costs is not possible or needs to be adjusted afterwards.[63] One may argue about the actual fairness of using current market shares in allocating responsibility for historical waste.

3.1.3.2 The false premise of avoiding retroactivity

The second claimed advantage of a market share based allocation of responsibility for historical waste is that it would avoid the problem of retroactivity. According to this train of thought, the act that establishes responsibility for historical waste is in the market share model not the original sale of the returned historical product, but rather the *current* sale of new products.[64] Hence, the responsibility would not be retroactive: if a producer sells nothing at the moment, there is no responsibility for returned waste, either. This logic nonetheless seems flawed, in particular if one assesses EEE producers as a group. It appears to confuse the notion of the fault that creates the responsibility with the subsequent allocation of such responsibility amongst the group of collectively responsible tortfeasors. To state this slightly differently, using analogies from tort law for guidance, claiming that sales of EEE today are causally linked to the environmental risk and harm of different, historical WEEE that are taken back seems dubious. It is as if a kind of strict liability (i.e. liability without fault) is established on the producers. It should also be recalled that even the WEEE Directive requires the responsibility for historical waste only to be "proportionate" – without reference to retroactivity one way or the other. Market shares are mentioned just as one example, and without distinguishing between past and current market shares. The crucial aspect for the analysis in this section is that while the apportionment may in market share systems be based on a current event, the sales, the liability itself seems still retroactive because it deals with the environmental impact of products sold before the provision came into force.

It seems consequently difficult to see any difference between individual and collective responsibility *from the perspective of the retroactivity* of the liability. If current sales – not sales in the past – are (erroneously) used in the market share logic as the event causing liability, then for individual responsibility past sales should not be the cause of liability, either. A parallel point of comparison in an IPR based system for historical waste would rather appear to be the currently materializing management cost of the (historically sold) waste that is being taken back. Or should responsibility for *new* waste be considered retroactive, if it were allocated on the basis of, say, the producers' average market share over the five preceding years, and thus extending to a time prior to the enactment of the law? From this perspective it would therefore appear more plausible to argue that individual and collective responsibility for historical waste are equally much (or little) "retroactive".

The issue of producers' responsibility for historical waste was raised, as noted, during the enactment of the WEEE Directive. The legislator wanted producers to be responsible also for historical waste. In response, the producers pointed out that such responsibility risked being retroactive. It would therefore in accordance with EU law be acceptable only for particularly weighty justifications. The European Commission was of the view that if the responsibility were collective and set on the basis of current market shares, the responsibility should not be considered retroactive. The discussion in the paragraph above demonstrates that the premise seems incorrect. Allocating a collective responsibility on the basis of market share does not seem to change the retroactive nature of the law. Because responsibility for historical waste can have no impact on product design, setting such retroactive responsibility on the producers seems ill-justified. Moreover, in the market share based allocations, the polluter pays principle is also conveniently cast aside.

The political economy of the issue became clearly visible in the Dutch ICT Milieu scheme. In the scheme, the consortium members' fluctuating market shares

[63] In the French legal system (Article 1384(1) C.Civ), a whole closed class of potential tortfeasors is made responsible in solidium in case their fault cannot be apportioned. German law contains a specific provision on these cases, making defendants jointly and severally liable (Gesamtschuldener) (§830(1) BGBII). In the UK, reaches a similar result by shifting the burden of proof on apportioning the causation to the tortfeasors (Cook v. Lewis [1951]). (Van Gerven, Lever & Larouche (2000, 444, 465); Deakin (2003, 249-55))

[64] Perhaps a third option would be to consider the *taking back* of the WEEE as the act that creates the producer's responsibility. Legally speaking, electronics *products* become *waste* at the moment that they are (required or intended to be) discarded (Waste Framework Directive 2008/98/EC 3(1)). Thus, the taking back of WEEE is the moment when *waste* electronics start to exist, and hence an environmental risk or harm is created. This interpretation however seems to confuse an obligation created by the law with the liability that ensues from causing an environmental harm. Although conceptually the creation of waste is indeed linked to the moment of take back, in practical terms the taking back of WEEE is the remedy, not the tort. The problem is the existence of WEEE, the environmental harms caused by its inadequate treatment. Hence, justifying the responsibility of producers for certain waste by the fact that the producers have been mandated by the law itself to take back that very same waste, appears circular at best. The *polluter* pays principle also appears poorly reflected in this line of thinking. Finally, the question of retroactivity hardly can arise if the responsibility is linked to a prospective act (i.e. the takeback) that the law itself created.

from a historical perspective had been a pressing issue.[65] In particular, a large PC manufacturer with a considerable market share in the past had seen a substantial reduction in sales in the end of the 1990s. Given its historical presence on the market, a large proportion of the total product returns in ICT Milieu were of its brand. Coupled with more recent, reduced sales, the producer had in comparison with its competitors much higher costs in proportion to the number of units placed on the market. Given the circumstances, the manufacturer threatened to leave ICT Milieu, unless the financing model was changed. ICT[66] Milieu indeed changed its financing structure from individual to a collective, market share based model. Other mitigating factors also contributed to the decision.[67]

3.1.3.3 New waste locked into collective responsibility schemes

Whatever benefits one may have foreseen for collective responsibility for historic waste on the EU level, they seem largely offset by a major unintended consequence on the national level: a lock-in effect. It has namely proved quite difficult in EU Member States to establish a system of collective responsibility only for "historical" waste, while simultaneously maintaining a parallel system for "new waste" on the basis of individual responsibility. It has remained difficult to efficiently distinguish between the two fractions of waste in practice. This is so even though there is a specific labelling requirement in the WEEE Directive concerning new waste.[68]

If new and historical waste are to be separated, the later in time the separation will start, the firmer the lock-in effect. If the volumes of historical electrical and electronic waste were allowed to grow further, their role in the system would remain dominant. The entire recycling systems may be geared towards historical waste and with it, collective responsibility, while ignoring to implement a practical solution fit for the recycling and financing of new waste on individual basis. The turning point may only be the future moment when the proportion of new waste coming in will have rendered the share of historical waste negligible, or the producer(s) with preference for collective responsibility have left the market. In the EU, many Member States have become stuck in a collective responsibility also for new waste. In fact, there are EU countries that actually incorrectly transpose the WEEE directive by mandating a collective responsibility for *all* waste; individual responsibility is not even an option.[69]

On longer term, once the share of historic waste in a company's waste stream has become negligible, it may become possible to escape the lock-in in collective systems. A company can threaten to leave the collective system, unless the producer's liability in the system is divided to correspond the actual share of its waste received. In other words, the producer demands the system to shift to individual responsibility. The producer's demand is credible: because the company is responsible mostly for new waste anyhow, it in fact is already operating in IPR mode. But the demand is also effective: should the producer leave, all other companies' shares of the collective liability would increase, potentially considerably if the leaving producer has a large share of the waste. To be able to threaten to leave, the producer must nonetheless be capable of managing a system of its own (or with selected partners). The establishment of parallel take-back systems by companies in countries where a collective system dominates despite a legal requirement to individual responsibility can thus serve a strategic purpose: they set up a credible alternative to the collective scheme.[70]

3.1.3.4 Treating historical waste as new waste – or leaving it outside EPR altogether?

The experiences from places where there have been no separate rules for historical waste–and consequently no market share based collective responsibility–appear interesting and thus worth investigating further. In the terminology of the WEEE Directive, historical waste is treated as new waste. The waste electronics law in, for example, the State of Maine in the USA makes no distinction as it states:

> "Each computer monitor manufacturer and each television manufacturer is individually responsible for handling and recycling all computer monitors and televisions that are produced by that manufacturer or by any business for which the manufacturer has assumed legal responsibility, that are generated as waste by households in this State and that are received at consolidation facilities in this State."[71]

Similarly, both new and historical waste are subjected to individual responsibility in the Japanese systems for household appliances and for IT equipment.[72] It is posited in this article that rather than locking in new waste in the same system as historical waste ("the EU approach"), it is old waste that could, *as a rebuttable presumption*, be managed as new waste ("the Maine approach"). This could ensure that the entire system functions on the basis of individual responsibility,

[65] See Annex 1 for further information on the Dutch scheme.
[66] ICT refers to the Information and Communication Technologies sector.
[67] See further in next Section (3.1.3).
[68] Article 10(3), WEEE Directive; Article 14(4), Recast WEEE Directive.
[69] Castrén, Paris 2010.
[70] Sundberg (14.1.2011).
[71] Maine Revised Statutes Annotated, Title 38, Chapter 16, Section 5, D1.
[72] Dempsey *et al.* (2010, 24).

which would be vital for creating appropriate incentives to design for the environment.

This presumption of managing old waste as new waste should, obviously, be open for challenge. In some states and sectors the situation may be quite different from that of EOL televisions in Maine. The presumption of managing all waste as "new" may prove infeasible, depending on the product and/or market in question. Such an approach seems only feasible when the proportion of historic waste within WEEE stream is sufficiently small. Large proportionate share of historical waste in the WEEE stream that comes back, or fundamental shifts in market shares, can render an individual approach inequitable or politically unachievable. A producer could have the right to claim, and bear the burden of proving its claim, that the presumptive individual responsibility is unfair. In such situations, the authorities would then be required to intervene with tailor-made calculations of more fair divisions of cost. For example, it could perhaps be required that new entrants to the market, who unlike incumbent producers would not under individual responsibility be responsible for any historical waste, were instead given a much more considerable, proportionately fair part of the responsibilities for orphan products (see next section) than the incumbents. Through such calculations, it would not only be possible but mandatory to level the playing field between incumbents and new entrants. The crux of creating this kind of specifically tailored models would be to obviate the need to start identifying and/or separating all new WEEE from historical WEEE, which is currently a major hindrance to setting up IPR based solutions. It may be difficult to implement such models in practice, however.

The viewpoints in this section support those presented earlier (see Section 3.1.3): it seems advisable to consider leaving historical waste outside of EPR altogether, and to simply charge the ensuing costs on the society at large. A retroactive responsibility for historical waste has no impact on the design of the products, it risks locking the treatment of new waste to collective schemes, and there seem to be great challenges in finding a solution whereby the costs are allocated in an efficient yet fair manner between the producers, in particular the entrants and incumbents.

3.2.1 How to allocate responsibility for orphan products and free riders?

Another issue in the WEEE Directive, where the division of responsibilities among the producers has proven problematic in terms of creating proper incentive structures, is the management of "orphan" products. Orphan products belong to producers that either cannot be identified, or have already exited the market when the cost of recycling the waste materializes, which may be years after the products were sold.

Orphan WEEE is in many WEEE systems to be managed in the same manner as historical waste: the aggregate cost of all orphans is divided in accordance with current market shares of producers of the relevant category of waste. There is, however, a difference of principle between "historical" waste and orphan waste products, where the orphans are new waste. Historical waste refers to waste from a period when there was not yet a legal obligation to take back WEEE (i.e. prior to August 2005 in the EU). Because the responsibility itself was established retroactively for historical waste – i.e. it applies to products that existed already before the Directive came into force – none of the authorities or producers can be considered to have been negligent in terms of such responsibility. The burden falls squarely on "equally innocent" parties. The design incentives are largely unaffected, as the recycling properties of already sold products cannot be changed. There is therefore also a better case for justifying the spreading the responsibility amongst the peers. In the WEEE Directive, the collective (joint) responsibility for historical WEEE does just that.

But for *orphan* products from *new* waste, the situation is different. There *has* been a producer, which the law[73] had, at the time when the producer's products entered the market, specifically charged with a future responsibility of taking back the product once it became waste. It is just that the producer of orphan product no longer exists when the cost materializes.[74] There may be more legitimate reasons (such as bankruptcy) and less legitimate reasons (such as a deliberate change of legal personality) for such absence, but it appears in any event questionable whether the existing, diligent producers should be asked to cover all the costs for orphan products from such new waste. The EU WEEE Directive unequivocally answers in the negative.[75] With better policy and public authority enforcement, the producers generating orphans from new waste may be caught, and the burden for managing them distributed more fairly. This question is dealt with further in the next Section 3.1.5 that discusses in particular the use of so called recycling guarantees to deal with orphans.

"Free rider" is the term used to describe the producers that avoid their responsibilities in a system of taking back WEEE. Free riders distort the design incentives of EPR in two respects. First, they are able

[73] In the EU the WEEE Directive, or, to be specific, the national law that implemented the requirement in the WEEE Directive.

[74] Kalimo (2004, 225-7; 2006 47, 500-2).

[75] Article 8(2) and Recital 20, WEEE Directive; Article 12(3) and recital 23, the Recast WEEE Direcitve: " – Each producer should, when placing a product on the market, provide a financial guarantee to *prevent costs for the management of WEEE from orphan products from falling* on society or *the remaining producers*".

to avoid recycling-related costs, and thereby enjoy of an unfair competitive advantage. This applies to investments in design-for-recycling, in particular. Theoretically, free riders should not be a major concern. The logic underlying individual producer responsibility is that the investments in DfE be *cost-effective*: the savings made in the end of life phase should surpass the initial costs of design changes. The problem is, obviously, that by avoiding the responsibility to take back their products, the free riders also avoid the consequences of their own poor DfE. The diligent producers face a double burden, if they are the ones to be burdened with the (costs of the) poorly designed orphans of the free riders alongside their own products. The design of the orphan products is unlikely to be optimised for takeback, and the diligent producers have no information on or control over such product designs. This implies that the entire end-of-life management system may either need to be divided into two (e.g. for products with and without hazardous components), or made suboptimal so as to accommodate also for the poorly recyclable orphan WEEE. A related concern is that the free riding companies' cost accounting is conducted incorrectly, as the costs of WEEE may not be included.

It was explained above how ICT Milieu altered its pricing when the ailing sales of a former major manufacturer rendered the recycling costs of its earlier sold products disproportionate. A mitigating factor that allegedly contributed to the decision of ICT Milieu to change its financing structure was the existence of parallel import(er)s. The gray imports[76] were felt to render it difficult to predict the consequent increases in brand-specific returns and recovery costs, in particular in terms of financial accounting. These kinds of perceptions may also have affected the EU legislators' vision on what would constitute an equitable IPR system,[77] and finally, a system of financial guarantees was established at the EU level (discussed further below).

3.2.2 *Recycling guarantees, a cure worse than the illness?*

To avoid free riding and orphan products, the WEEE Directive requires[78] a recycling guarantee from all producers that place products on the EU market.[79] The guarantee means a mechanism for providing certainty that there are the appropriate means to actually deal with waste products once they are recovered in the end of the useful lives. The guarantee may take the form of participation by the producer in appropriate schemes for the financing of the management of WEEE, a recycling insurance policy or a blocked bank account. The Directive's list of alternatives does not seem exhaustive, taking also into account that the WEEE Directive is a minimum harmonization law[80] under Treaty on the Functioning of the EU Article 192.

While the guarantee targets free riding producers, it may in parallel create a mechanism to encourage EU Member State enforcement actions against such free riders and orphans. A properly enforced guarantee should, in principle, completely abolish the problem of orphan products, because their financing has been ensured *ex ante*. If the authorities have failed their explicit duty to ensure through proper enforcement that sufficient guarantees from all producers on the market have been collected, then surely these authorities cannot shift the responsibility–for the second time–to those producers that have already duly once paid for their waste.[81]

The guarantee system proposed in the WEEE Directive for addressing the issue of orphan products appears nevertheless problematic with respect to the division of responsibilities among different producers, and the incentives to Design-for-Environment. It also appears onerous and expensive to put into place, in particular when the free movement of products and waste between the EU Member States is taken into account.[82] Guarantees would require distinguishing between compliant and non-compliant products. Should the guarantees be actually properly implemented in the different Member States, they could also vary in size. The WEEE Directive leaves the levels of guarantees to the discretion of individual countries, yet the states may have very different efficiencies and strategies in managing WEEE.

There could also be the issue of products moving between the EU states once inside the internal market. Guarantees set up in the Member state of (first) importation into the EU would not be available for financing orphan products that may later become waste in a different Member State. The WEEE Directive could therefore work against its very purpose of promoting an internal market, where goods and waste are to flow freely across EU borders for optimal (eco-)efficiencies, and the playing field between producers in different Member States is leveled.

The easiest option to prevent fragmentation would

[76] Gray imports, also called parallel imports, refer to imports of goods through distribution channels which, while not illegal, are unintended, unofficial or unauthorized by the producer.

[77] "IPR system" refers to takeback and recovery systems designed to permit or enhance the possibility of IPR.

[78] Recital 20, Article 8(2)(2); Recital 23, Article 12(3)(2), Recast WEEE Directive.

[79] There is also a second reason for guarantees: they can be used to finance unpredicted increases in future recycling costs.

[80] Minimum harmonization means that the EU standard is only the minimum level of protection required. The Member States are free to opt for levels that surpass the EU standard.

[81] Sundberg 14.1.2011.

[82] Kalimo (2006, 503-17).

seem to be to simply ignore the complexities and the potentially uneven distribution of national guarantees. One could merely rely on the guarantees required in the state where the product was initially placed on the market, if the differences in the accumulated guarantees are assumed smaller than the additional costs of managing and re-distributing the guarantees between the Member States.[83]

In fact, a cost-benefit analysis could render the entire guarantee system redundant. The reliance on market share based financing in (most of) the EU hides the volume of orphans in the system. Experience from the state of Maine in the US suggests that the magnitude of the entire problem of orphans needs to be more carefully analyzed: information collected in 2008 indicated that there, less than 5 per cent of the returned TVs would be considered orphans.[84] In the state of Washington the corresponding share was 10,5 per cent for 2010.[85] Both Maine and Washington successfully assumed that it would be cheaper and less burdensome for the existing producers to simply pay for the management of orphans as they accumulate, rather than to set up complicated guarantee structures in-between. Whether the absence of guarantees will lead to an increase in free riding can only be assessed later, however. In Maine, computer monitor and television manufacturers with more than 0,1 per cent annual market share were responsible for a pro rata share[86] of returned orphan waste computer monitors and televisions, respectively. In Washington, the responsibility for recycling orphan products is distributed among all identified manufacturers in proportion to their share of the returned WEEE.[87] This type of practical and simple solution has the fundamental advantage of not increasing the complexity, rigidity and cost of the IPR takeback system, which in turn could be fatal to the incentives to design for recycling.

The harmonization approach of the current WEEE Directive with regard to the guarantee system seems therefore problematic. The conclusion must then be to allocate the cost for orphan products differently. In order to allocate the responsibility for orphan products to producers, however, the applicable legislation would need to define the producer responsibility jointly. A strict, tort law based interpretation of the individual producer responsibility would not seem to grant the appropriate legal basis for charging the producers with responsibility for managing end of life products that are not those of the producer itself. Any expansion of the scope of responsibility from individual to collective (joint and/or several) responsibility should be taken with utmost care, however. It was discussed in this article how the application of collective responsibility[88] may easily lead to a lock-in, whereby simultaneously operating systems that do allocate products and/or their costs individually, are no longer able to function properly. Consequently, much of the foreseen design incentive structures could be in jeopardy. This is not justifiable, in particular not where the amount of orphans is small.

It is difficult to envisage, given the apparent unwillingness of governments to pay for orphans, a practical solution that is consistent with the aim IPR to make each producer responsible for their own products within WEEE. A possible political compromise (yet still far from ideal in respect to the principle of IPR) could perhaps involve the allocation of half of the cost on the society, half on the existing producers on the basis of pro rata return-shares. This might serve as a type of middle ground between individual and collective responsibility, assuming that the amount of orphans is small in accordance with the experience from Maine.[89] Of the existing producers, the new entrants could be given an adjusted, higher share than the incumbents to even out the latter's potentially heavier responsibility for historical waste (see the two preceding Sections). The society at large would be charged to carry the responsibility for the other half of the cost of orphans through general tax funds so as to create incentives for proper enforcement against the orphans, as was discussed earlier.[90]

The negative effects of historical waste and orphans on individual producer responsibility are important, although only indirect. Both historical waste and orphans are of course beyond the DfE actions of the producer, which are the core of IPR.[91] Also, the feasibility of the above proposals depends crucially on the costs in comparison to the costs of a guarantee system. The amounts of historical waste and orphans in the sector are important variables: if the market share of potential free riders is substantial, specific actions such as guarantees may be vital.

3.2.3 Visible fees

In the original WEEE Directive, the producers were, for a transitional period of eight[92] years, explicitly granted the right to show purchasers the cost of the end of life management of waste separately on top of the price of the product. The practice is commonly referred to as setting a "visible fee". The provision

[83] This would not solve the potential problem of Member States starting to act as "hubs" for imports, attracting imports of electronics from "forum-shopping producers" by requiring lower guarantees than their neighbors. This problem is currently purely theoretical, however.
[84] Dempsey *et al.* 2010, 36.
[85] Final 2011 Orphan Brand Returns.
[86] Calculated annually by November 15 on the basis of the previous year's amounts.
[87] Final 2011 Orphan Brand Returns.
[88] In the commonly used (misleading) sense of the term.
[89] This will depend on the individual product and geographical market in question.
[90] See Sections 3.1.2 and 3.1.4 above.
[91] Van Rossem (2008, 260).
[92] Ten years for category 1 waste.

only applied to historical waste; visible fees were specifically prohibited for new waste.[93] The recast WEEE Directive, however, no longer limits the producers' right to set visible fees. Fees are now accepted for an unlimited time, and also for "new" WEEE. Moreover, individual Member States may require producers to do so.[94]

Visible fees have both advantages and drawbacks. European Parliament did not during the first reading to recast the WEEE Directive agree with the Commission's amendment to expand visible fees to all WEEE, but later compromised on this point.[95] Visible fees may serve an environmental purpose. They may increase consumer awareness: putting a separate price tag on the management of WEEE may be more effective a message to consumers about the environmental impact of their purchase than simply noting that the overall price includes such a cost. A separation of the fee from the product price may also facilitate comparisons between the eco-efficiencies of the producers, which would be well in line with the incentive structures of EPR. The assumption is that the fee realistically reflects the costs, both in including *only* the WEEE management costs, and in covering *all* such costs. The assumption also is that consumer demand is elastic regarding even such small amounts. The French IPR system on WEEE, for example, uses visible fees that are differentiated in function of certain characteristics of the end of life product.[96]

If the EPR costs are dealt with as a separate amount that may not be altered in the sales channel, there are better chances for resisting price erosion.[97] Retail chains in the sales channel and the end consumers at the point of purchase exert their bargaining power on the overall product price, including the recycling cost. As a separate fee outside of the bargaining process, the producers may be able to transfer a larger part of the cost onwards.[98] A separate, visible fee is hence reminiscent of a (partial[99]) delegation of financial responsibility away from the producers. This type of protection of the producers could be useful in obtaining their political support for WEEE policies.[100] The support may come with too high a price, however. Visible fees that are set at the same level and are thus immunized from competition have the tendency merely to constitute concerted, uniform price increases. The price fixing element in the visible fees may also attract the attention of the antitrust authorities. Immunity to competition would in more general terms reduce the producer's incentives to invest in a more environmental design.

A further complication is the WEEE Directive's lack of full harmonization regarding the visible fees. At the Member State level, the producers face a fragmented field where the visible fees may be mandatory, prohibited as well as optional, and are arranged in different ways. This makes the administration of fees burdensome to deal with.[101]

All in all, the crucial point from the perspective of design incentives is not to confuse the visibility of an *individual* producer's fee within the sales channel with the fees being fixed and identical *across* all *different* producers. The individual producers must be subjected to competition and thereby also given a chance to benefit from their measures to lower the costs of recycling. A uniform fee may hinder this. Artificially high fees will in any event decrease consumer welfare.

3.3 EPR at the (Member) State level

3.3.1 Transposition that favors collective responsibility

In the multi-layered governance structure of European Union, the extended producer responsibility requirements set up at the EU level in the WEEE Directive need to be transposed into national legislation.[102] This has proven challenging. The varying and inadequate transposition by Member States has been particularly problematic with respect to the design incentive structures of individual producer responsibility.[103] The key objectives of the Directive are in jeopardy. The problems in transposition should come as no surprise: a majority of the states in the Council, the EU's co-legislating institution that consists of the Member States, displayed opposition towards individual producer responsibility during the legislative process at EU level. In other words, many European countries simply do not support full-fledged IPR. They may understand extended producer responsibility in a much more rudimentary way: it is simply a means to shift the financial burden of waste management policies from the official, politically sensitive state/municipal budgets to third parties with deep pockets.

Van Rossem identified three main patterns as of 2008 in the transposition of the WEEE Directive's

[93] See Articles 8(2)(3) and 8(3)(2), as well as recital 20. Historical waste refers to waste put on the market after 13 august 2005.
[94] Article 14(1) in the Commission's Proposal to Amend the WEEE Directive COM(2008)810; Article 14(1), WEEE Recast Directive.
[95] Article 14(1), European Parliament legislative resolution of 3 February 2011 on the recast WEEE Directive.
[96] Cahier des charges; Enagagements annexés; OCAD3E..
[97] Price erosion means the gradual decrease of the product's price, and consequently of the profit margin of the producer.
[98] Kalimo (2006, 491-3).
[99] The scope of actual delegation will depend on the price elasticities, i.e. on the producer's ability to insulate the EPR cost from the profit margin.
[100] See e.g. Stevels (2001).
[101] Magalini *et al.* (2006, 3).
[102] The question of whether the WEEE Directive's requirements would also be "directly effective" without such national transposition is here set aside.
[103] Van Rossem, Tojo & Lindhqvist (2006).

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EPR requirements.[104] Only nine[105] out of the 27[106] Member States have transposed extended producer responsibility in a manner that distinguishes individual responsibility for new waste from collective responsibility for historical waste, as the WEEE Directive requires. Eleven states[107] have left the distinction between the responsibilities ambiguous in their transposing acts, while eight states[108] have simply ignored it.

Concerns over the fate of individual producer responsibility in the WEEE Directive had already in the beginning of the millennium brought together a group[109] that consisted of both electronics producers and green NGOs. The group was worried in March 2007[110] that while IPR was firmly established in 2002 in the Directive itself, the inadequate transposition of individual responsibility would hinder the desired competition in innovation, business models, take-back logistics and design changes: in short, the transposition would compromise the incentives in many different respects.

A fundamental problem is that the transposition in many countries does not acknowledge the Directive's key requirements, such as that to allow the producer to choose whether to fulfil its financial obligations individually or by joining a collective scheme.[111] The national transpositions do not always make the distinction between the legal obligation on the producer to be individually (or collectively) responsible for WEEE, and the means through which the producer decides to fulfil such responsibilities in practice. There is also ambiguity in what constitutes "individual" responsibility, and on the differences between financial and operational responsibilities.

Considering the confusion around these fundamental elements of producer responsibility at the level of the WEEE Directive–and perhaps in general–problems in transposition are only to be expected. The 27[112] jurisdictions have their legal, economic, political and cultural differences, which will inevitably translate any vagueness in concepts into fragmentation and contradicting rules. It was claimed earlier that individual financial responsibility means the financing of only the costs directly and actually associated with the producer's own WEEE. Using proxies in determining and attributing the costs for new waste is likely to lead to unacceptable averaging of cost across the producers. It was claimed above (see Section 3.1.2) that determining the actual costs of each producer's products is the most accurate means to apportion also collective responsibility in function of each party's liability. Proxies such as current market share should be resorted to only if the presumption of using actual costs of each party's products would lead to an unfair allocation of responsibility.

By specifically referring to both individual and collective *schemes* in the *fulfillment* of their legally-mandated financial obligations, the WEEE Directive's text would in any event appear to support collaboration between the responsible producers in the practical handling of waste..

In order to determine the nature and scope of the desirable collaboration, the precise scope of the individual companies' responsibilities would need to be known. There are various issues here to be taken into account. For some manufacturers, the fulfillment of individual producer responsibilities through an take-back scheme operated by an individual producer may be costlier than would participation with other companies in a collaborative system. Takeback systems of single companies may be less likely than collaborative systems to secure the volumes required for the economies of scale and scope in end-of-use product processing. From a producer's perspective, the savings due to economies of scale and scope in a collaborative system need, of course, to be assessed against the potentially added expenses.[113] Gui *et al.*[114] have shown with game-theoretic modeling that the calculation on whether to collaborate, on what and with whom involves many dynamic variables and is therefore rarely straightforward. In particular, the collaboration should not jeopardise the savings that the producer's investments in changing the design of the product would have entailed.

Washington state, for example, is operating in 2011

[104] Van Rossem (2008, 158).
[105] Belgium (Brussels and Flanders regions), Cyprus, Czech Republic, Estonia, Luxembourg, Malta, the Netherlands, Romania and Slovakia.
[106] Note that the three Belgian Regions are below calculated separately.
[107] Austria, Belgium (Walloon region), Germany, Hungary, Ireland, Italy, Lithuania, Poland, Portugal, Spain and Sweden.
[108] Bulgaria, Denmark, Finland, France, Greece, Latvia, Slovenia and the United Kingdom.
[109] Many of the actors that have come together to express concern over the MS transposition of Article 8(2), were the same ones that developed a similar joint statement in 2002 that strongly encouraged the EU institutions to incorporate IPR in the WEEE Directive. (Environment Daily (2002)).
[110] *Ibid.*
[111] Van Rossem 2008, 153-165.
[112] Counting also the regions and other smaller units of governance would of course increase this figure considerably further.
[113] Huisman *et al.* (2006); Atasu and Subramanian (2011). Economies of scale usually refer to a diminishing average cost per a new unit. Economies of scope usually are taken to mean that average costs are diminished because, e.g., the same indivisible assets may be used in the production of *two or more* products. The reverse logistics system for collecting back WEEE by brand could, for example, be exponentially more expensive than doing the same for all brands at the same time. There are nonetheless WEEE takeback systems, such as the Japanese IT takeback system, were also the collection takes place on brand specific basis.
[114] 2011.

a plan where the cost sharing arrangement is a mixture of return share and market share. However, the plan does not seem effective and the individual producers' cost shares may not be fairly distributed.[115] This is likely to diminish the producers' incentives to optimise their designs for the end-of-life phase.[116]

Indeed, as was argued previously, the Member State transposition of the WEEE Directive should take note of the fact that *both* individual and collective producer responsibility necessitate as accurate an allocation of products and/or costs as possible. If the costs cannot be accurately allocated, the design incentives are in most cases lost. A requirement of a more accurate allocation in collective takeback schemes will drive such schemes towards supporting producers' design incentives, and thus towards IPR. The Swedish ELV scheme[117] and the scheme developed by Mayers *et al.*,[118] which are paving the way in-between purely collective and individual takeback schemes, would benefit from a more accurate allocation of costs. In a takeback system based on individual producer responsibility the importance of accurate allocation is even more far reaching. The legal basis for charging to a particular producer the costs of any products, which can*not* be attributed to that producer, seems questionable from the perspective of tort law and the polluter pays principle, and could therefore be open to a legal challenge.[119]

3.3.2 Guarantees revisited – national requirements that disadvantage individual responsibility

Another point where the inadequate transposition by Member States may threaten the incentive structures of EPR relates to WEEE Directive's guarantee requirement. That being said, the guarantee system also appears to be subject to an unusually high degree of confusion and conflicting viewpoints at the state level. Many producers attest to the importance of guarantees[120] – yet in practice none of the EU Member States have actually implemented them.

According to the WEEE Directive,[121] the Member States need to require the producers to provide a guarantee that the future management of their WEEE will be financed.[122] "Participation in appropriate schemes for the financing of the management of WEEE" is in the Directive noted as an example of a guarantee. All EU states have interpreted a membership in a *collective* (collaborative) takeback scheme to establish in itself an adequate guarantee.[123] This is positive in that the public authorities could be thought to more readily closely monitor the companies' participation in collective schemes, and thereby make sure that adequate guarantees are created. In practice, such monitoring usually does not seem to take place.[124] Moreover, many states have in the transposition interpreted an individual producer scheme not to be sufficient: producers that would want to start their own take back system would need to provide a separate guarantee. Only Sweden and Germany require a separate guarantee from all producers, regardless of whether they are part of an individual or a collective takeback system. Relieving companies in collective schemes from a separate guarantee requirement creates competition-distorting effects vis-à-vis producers who wish to operate their own takeback systems and need to have a guarantee. The preferable treatment further tightens the lock-in to collective takeback schemes.[125]

It is therefore not only the lack of enforcement regarding free riders and the resulting orphan products that risk hindering the incentives of IPR: guarantees that have been improperly implemented may have a drastic impact as well. In some alternatives, such as blocked bank accounts and certain insurance schemes, accumulation of funds[126] is necessary. It is far from clear, however, whether the collected funds actually are assessed by anyone for being adequate and in any relation to the risk liabilities of the participating companies. Time wise, they do not seem to extend beyond the duty to handle waste during a single accounting year. The guarantees based on memberships would also appear to require some kind of contractual clauses to protect the system against sudden defections or discontinuations of its key members–a requirement that is unlikely to be fulfilled. It appears that the guarantee systems are not properly enforced, which ever their form.[127]

If guarantees, and hence accruals,[128] for recycling new waste were indeed required of all companies, the benefits of proper design for environment could

[115] See Gui *et al.* (2011) for further discussion.
[116] See Atasu and Subramanian (2011) for further discussion.
[117] See Section 3.2.2 (Guarantees revisited) below and Annex 1 for further information on the Swedish scheme.
[118] Forthcoming..
[119] On the potentially problematic aspects of different parties "over-collecting" and "under-collecting" WEEE in the UK, see Case No: CO/1934/2009,
[120] IPR Workshop January 13 2011.
[121] Recital 20, Article 8(2)(2); Recital 23, Article 12(3)(2), Recast WEEE Directive.
[122] See Sections 3.1.4-5 above.
[123] Van Rossem (2008, 169).
[124] Sundberg (14.1.2011).
[125] Cf. with Huisman *et al.* (2006, 2) who, to the contrary, claim that guarantees should *not* be required of producers that are part of collective schemes.
[126] I.e. up-front accounting of expenses that are relatively certain to materialize later in time.
[127] Sundberg (14.1.2011); IPR Workshop (13.1.2011).
[128] Accruals are amounts held against liabilities on a companies balance sheet. This is relevant for historic and future WEEE costs. A financial guarantee is an assurance that a certain liability will be paid for even in the event of bankruptcy. This is relevant for future costs and IPR, and for historic WEEE costs in Germany only.

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Figure 2. Recycling Insurance model for the Swedish EOL vehicle and WEEE markets (Länsförsäkringar is the Insurance company).[129]

become immediate: assuming that the accruals take the implications of the design for the end-of-life costs into account, the most environmentally-progressive companies are better off. A further incentive to design for the environment is created.[130] Moreover, Mayers reminds us[131] that for a certain period of time, the producers would face a double payment: historic waste is paid for upon its arrival in treatment, in parallel with the accumulation of the accruals for future waste.

There may exist also solutions that represent a combination of the collective and individual takeback schemes. In Sweden, an insurance company has taken an active role in developing solutions to extended producer responsibility requirements. It first created an insurance solution for the Swedish vehicle takeback market, and then proposed a modified version of the solution for the Swedish WEEE market. The insurance company acts in both systems as a central agent, to whom each producer pays a one-time upfront premium per product. The negotiated premiums reflect the size of future EPR obligation of the producer. The premiums are based on the estimated future recycling costs, which in turn are determined on the basis of a test scrapping that takes into consideration the applicable legal requirements. Elements of individual producer responsibility are hence clearly visible: premiums are differentiated on the basis of the product features, which creates incentives for producers to engage in further design for environment. In fact, incentives are also created to improve the processing technologies, leading to dynamic efficiencies

In the WEEE insurance system, which has not yet materialized in practice, the producer and the insurer would also have agreed to estimate a typical rate of expected return of WEEE over a specified time period. The insurer would then pay for all insured products according to an agreed scrapping curve, which reflects the expected rate of returned products. The insurer's payment would equal the actual end of life cost per product multiplied by the number of insured products. If the actual end of life cost per product were higher than expected, the insurance would cover the difference up to an agreed level, usually 150 per cent of the originally expected end of life costs. If the actual costs turned out to be *lower* than expected, the savings would fall under the profit sharing agreement between the producer and the insurer. There is an incentive for the producer to lower the actual end of life costs through design for recycling and more efficient collection and recycling processes. The insurance company's refunds would also have taken into account the uncertainties in the future costs.

Another problem with the WEEE recycling insurance has been the uncertainty of the return percentage of sold electronics. For instance, cell phone[132] return rates in Europe may be as low as around 5-10 per cent of the annual sales.[133] It does not make sense from the

[129] Mayers (2010).
[130] 2010, 12-15.
[131] Sverkman (2010).
[132] I.e. mobile phone.
[133] Castrén (25.2.2010).

cell phone manufacturer's perspective to pay a premium for 100 per cent collection and then only collect a mere five per cent of the products. A solution to this problem could be to adjust the scrapping curves by different sectors/products, and to limit the payment to the amount of insured products rather than sales. Even this appears very difficult to predict, however.

The Swedish insurance systems have also elements of collectivity. In the vehicle system there is a single central agent managing the end of life activities, and it also provides for a guarantee that covers the future cost of scrapping each of the participating producers' cars, whether the producer still is on the market or not. However, there seems to be no joint funding of the end of life products, because the upfront premiums of each producer create the funds to cover the ensuing costs of *that* producer. Consequently, products of non-participating producers, who have not in advance paid the necessary premiums, will not be financed.

All in all, a recycling insurance could as a guarantee provide some advantages to mere blocked bank account, although the system is quite complicated and there is only limited experience on how well it functions in practice. It creates design incentives by basing the upfront premiums on the expected future costs through the environmental qualities of the product.

3.4 EPR at the municipal level

In all developed countries, there exists a collection and treatment infrastructure for household waste. In most cases, the infrastructure is managed at the level of the municipalities. Some WEEE takeback and treatment infrastructures have grown from such municipal solid waste management systems, while in other countries commercial operators manage the system. In both cases, many of the layers in the system are not fully competitive. Even more difficult is to make sure that the producers' design incentives remain viable in such a system. One example on how to pursue this may be found in Japan.

In Japan, producers have operational responsibility for recycling WEEE. In order to fulfil their legal obligations, the producers have formed two groups: Group A (21 manufacturers) and Group B (22 manufacturers). Group A manufacturers have chosen to subcontract the recycling as much as possible to existing recycling companies. Certain producers in this group have also invested in their own recycling plants. Producers in Group B decided only to establish jointly-owned recycling plants of their own, rather than subcontracting with existing recyclers..[134]

The producers in Groups A and B are responsible for financing the recycling of their own branded units, handled by the respective recycling consortia. There is no differentiation within either Group A or B between the costs to manage the individual brands.[135] The product design improvements that result in reduced end-of-life management costs are therefore not directly financially rewarded; rather, any savings through efficient processing or product design are shared among all members in the recycling consortium. The cost savings therefore benefit the producers jointly, but this has been sufficient to create at least weak incentives for the manufacturers to design more easily recyclable products. The incentive is not driven by competition between the brands, but by the shared savings, collaborative management and the competitiveness of the Group's solution when compared to the collective system of the other Group. The competition in Japan on product take-back systems is in other words not over the recycling fees charged to the consumers–it is rather over the recycling costs.

Similar incentives to develop recycling technologies in synchronization with the products would appear achievable also with other forms of more intensive collaboration between the producers and the recyclers. Collaboration in the collection of WEEE is also likely to lead to considerable savings, as has been explained earlier.[136] In the end, cost reductions are usually beneficial to all parties. The prospect of legislation, such as the Japanese SHARL, may give a further incentive for the producers to seek savings.[137]

The main advantage of the SHARL system is the creation of a *direct link* between the downstream management of waste products and the producer. The system allows the producer to get direct product design related feedback from the recycling plants about the end-of-life qualities of their products. The feedback from the recyclers can encourage proposals for design improvements on issues such as material composition, ease of disassembly and labelling. There is evidence of the manufacturers in Japan having undertaken at least the following activities:[138]

- Use of DfE assessment tools
- Marking of materials and locations for the ease of dismantling
- Harmonization of materials (plastics and magnetic alloys)
- Reduction of the number of components and screws
- Standardisation of screws
- Recycled components use
- New recycling technology developments
- Plastics separation
- Tools for ease of manual dismantling and
- Communication between recyclers and designers

[134] DTI (2005).
[135] Dempsey *et al*. (2010, 21).
[136] See Section 3.2.1. The Japanese IT takeback scheme is, however, an example where the producers, in collaboration with the Japanese post, collect back their own products (Dempsey *et al*. 2010, 17-22).
[137] Tojo (2006).
[138] *Ibid.*

Identifying an efficient IPR structure requires systematic thinking on the part of the producers. Viewing the issue from the perspective of the IPR strategy of a company, the question arises whether it should rely on the most commonly available takeback and recovery infrastructure – the municipal waste management system, or if it should rather act individually, or should it form coalitions with its peers to deal with its operational and/or financial producer responsibility? In fact, combinations of these alternatives also exist. The disadvantage of an individual, separate infrastructure may be the poorer economies of scale or scope. Unless the end-of-use flows are insignificantly low, i.e., the total costs associated with return processing are low,[139] or the flow is significantly high to realize the economies of scale or scope, manufacturers with separate infrastructures may be worse off than when relying on a municipal system or when collaborating with their competitors. Separation by brand of the returned WEEE may be problematic even in a separate infrastructure of an individual company, because other brands are always likely to unintentionally end up in some quantities in the collection infrastructure. The points of contact with potentially used related infrastructure, such as a municipal collection systems for the initial collection of WEEE, may also be problematic. An individual collection system could avoid privacy concerns more easily, as it would be easier set up standard procedures to erase the potentially reusable memory chips, for example.

In the end, the choice between the various types of municipal and private takeback and recycling systems and their practical implications is a question of trade-offs. The main advantage of shared infrastructures is the economies of scale in collection and treatment. From the perspective of establishing individual responsibility, however, the main objective is to ensure effective incentives for DfE. The means highlighted above to identify and separate branded products from one another work towards reconciling these two objectives. Moreover, to ensure the efficiencies of the solutions, there should be competition during all of the phases of the takeback and recycling life-cycle, from product design to collection and treatment.

IV. EPR on the Practical Level

4.1 Takeback systems fail to recognize investments in DfE

In the EU Member States, the practical management of WEEE currently relies on producer responsibility organizations (PROs). There were over 260 such organizations in Europe as of 2007.[140] Most PROs today base their financing on funds from producers. Two principal models exist: a market share model and a return share model.

Market share based financing means that producers pay for the treatment costs of all collected WEEE within the sector in proportion to their market share of EEE products sold at the time of recycling. In practice this means that a fee is collected from the producer on each product when it is placed on the market, but that fee is used "inter-generationally" to finance the management of EOL products that are being collected and treated at the same time.[141] As was explained above, the fee may be passed to the consumer as a separate element visible on top of the product price, or integrated in the overall product price. The financing may also be based on a return-share model. Here, compliance fees are levied on the producer on the basis of the calculated share of its units that are returned through the collection system.

A takeback system essentially will therefore need to be able to quantify the number of units (i.e. product volumes) at a specific point of the life cycle. Obtaining figures on product sales is usually rather straightforward, but may take time. If fees are collected at the time of sales, they will correspond the sales volumes and market shares without a need for a separate calculation. The calculation of the shares of returned units may be based on either actual physical count or representative samples taken in predetermined intervals.[142] Differentiation based on the characteristics of the product (such as its weight or environmental impacts), and the costs of managing the product in the end of its life, require a more detailed analysis. Actual separation of units per product type or producer has so far been effectuated mostly manually.

The Dutch ICT Milieu system provides an example: even before the WEEE Directive was enacted, and up until 1 January 2003, every item of WEEE delivered in ICT Milieu system to the recycling company was manually identified. Each product was weighed on a scale. Brands were visually identified and each unit was assigned to a manufacturer and logged using a touch screen panel. Although the recycling itself was done in a single common stream of WEEE, individual producers received a monthly invoice directly from the recycler based on the weight of each brand's recycled products. The weight-based calculation of the recovery cost was simple and clear. The cost of the manual sorting was a few cents/kg. The experience casts doubt on the claims that sorting products by brand or model is prohibitively costly, even when performed manually.

Moreover, automation of product identification

[139] A producer could only benefit from a low flow of WEEE if the relevant public policy (i.e., the recycling targets) were low. Some states in the U.S. such as Oklahoma require takeback of WEEE but do mandate quantitative targets.
[140] Mayers (2007, 115).
[141] Van Rossem (2008, 26-27).
[142] *Ibid.*

through means such as equipping EEE with bar codes and radio frequency identification (RFID) tags has for long been envisioned as a possibility to further improve the economics of this activity.[143] In a conveyor system equipped with RFID, individual brands and models of individual items may be identified on an automated basis. Even dirty and scratched products may be identified and then separated. The ID tags would also help to automatically distinguish between historic and new waste, where these fractions are dealt with or financed under different rules (e.g. market share v. return share based financing). Finally, automatic product IDs could be linked to databases containing information on material content and treatment information for the purposes of facilitating optimal product recycling and recovery. However, the practical challenge is that the RFID systems are largely used for shipping containers or pallets. Most products themselves on the market today do not yet carry RFID tags, nor is it clear how long the tags would remain serviceable for. There may also be a risk of the RFIDs being tampered with, removed and reinstalled to the wrong products. Indeed, the up-front investments in tagging the products, as well as the operational changes required of the stakeholders that collect and treat WEEE, render the future of RFIDs quite uncertain.[144]

Whereas the future of RFIDs remains vague, there seems to be great potential for IPR to drive recovery process-related innovations. The advances in the end-of-life recovery techniques of scarce metals, for example, may be fundamental from an environmental perspective.[145] Still, these types of process based changes may be easier to achieve than alterations in products, because the latter need to fill so many competing objectives from aesthetic appeal to product safety. The crux is to take the link between IPR and recovery processes much more into account while developing takeback and recovery policies.

In Nordic countries, brand recognition trials have been conducted to identify the amount of different individual WEEE products in the waste stream. Producers provided information on types of products and models, while recyclers selected target regions for the trial on the basis of sales figures, population and waste flows. Batches of WEEE in the target regions were then sorted by brand and/or product type. The system enabled a separate dismantling service that could take into account the specific designs and component structures of the actual, separated products. The system also charged the producers by the actual cost of such product type-specific treatment, such as the purchase and operation of specific equipment used for the processing of WEEE. The Nordic trials achieved individual producer responsibility to a considerable extent, proving that costs could in practice be allocated at least by product types at a reasonable cost.[146]

Sampling of WEEE has been proposed as a further alternative to approaches such as the actual product counts that are effectuated either manually or using RFID-type automatic product identification. There has been progress on the methods of accurately sampling the content of a waste electronics flow, although a number of problems remain to be solved.[147] In the state of Washington, the return share of different products is already today calculated statistically by sampling. The Department of Ecology in the state determines the return shares for manufacturers on the basis of the return share data that is available from the *Brand Data Management System (BDMS),* developed by the U.S. National Center for Electronics Recycling (NCER). The sampling applies to producers participating in the Standard Plan, the basic solution proposed by the Washington State environmental authorities. It would also apply to the Independent Plans of the producers, if such plans existed.[148] The BDMS reporting offers data on, for example, brand return rankings over time and products identified as orphans. Sampling is also used in the Bosch Power Tool Consortium.[149] The 22 brands that were part of the *Phase 1* of the Consortium in [date] continue to finance the collection of their own branded WEEE from service centres, retailers as well as commercial customers.[150] For tools collected at retailers, however, the brands are no longer comprehensively identified. Instead, sampling is used to estimate the relative brand return-share attributed to each producer.

The Japanese SHARL offers other practices that can contribute to achieving IPR. Using a so-called recycling bill, i.e., a manifest, it is possible to trace which collection point and recycling plant an individual product has entered. The product flows are recorded by brand and product category. Both producers and end users can track and make enquiries on the status and treatment location of their products. By distinguishing the brands of products and subsequently collecting data on the recycling costs for different designs, each producer has rather good control over the fate of its products in the end-of-life management phases of recycling and repairing. The recyclers benefit from the manifest system because it enables them to identify the producer of the product;

[143] Parlikad and McFarlane (2007); Cronin, *et al.* (2009).
[144] CECED 2004.
[145] University of Tokyo.
[146] Castrén (25.2.2010). The finding is consistent with previous experiences from the Dutch ICT Milieu system, where the cost of the conducted manual sorting of WEEE was only few cents/kg (Electrolux *et al.* 2007, 19-20).
[147] Rotter (2010).
[148] See further down in this section for more analysis on both plans.
[149] See Annex 1 for further information on the Bosch Power Tool Consortium.
[150] The amount of waste collected by producers themselves is included in business to consumer (B2C) tonnages as producers declare it as B2C when placed on the market.

the public authorities obtain statistical data on collection and are able to trace individual waste products. Overall, the information flows make the decisions of the various stakeholders relevant to product design considerably more reliable. The advantages of the manifest solution set up under SHARL appear similar to what a RFID system could offer, although the manifests lack the physical and IT advantages of RFIDs. There is a fundamental practical difference, however: the manifests are already in use in Japan, whereas the deployment of RFIDs is still only under consideration.

All in all, the actual counting, as well as the manifests are capable of taking the return waste stream analysis beyond determination of the mere unit volumes by brand. They also are capable of physically separating different product models from one another, thereby allowing for a more accurate assessment of the environmental impacts and costs for managing the product. By finding out the actual costs per product, a basis for creating accurate incentive structures for design innovation under IPR may be established. Accurate calculations on the quantities and costs will also benefit closely related issues such as deciding on the appropriate measures (if any) to deal with orphan products. In a typical return share system today, the costs of WEEE are not differentiated by their impact on the collection and processing expenditures or environmental impact. The majority of the return share systems are therefore still not based on individual producer responsibility in the strict sense of the term: they are not yet conducive to creating incentives for more sustainable (W)EEE.

The progress in the possibilities to obtain more accurate information on the returned WEEE is therefore quite promising. Policy measures need to be taken up prominently, however. The end-of-life treatment of WEEE is fast moving towards a predominance of non-brand specific bulk shredding, as will be explained in more detail below. Also, as van Rossem has pointed out,[151] the dilemma is that the main consideration of most PROs still remains to ensure the funds necessary to run the organization, *not* to steer the design decisions of the producers. The main challenge is therefore both to technically and legally create the opportunities for IPR, and to prompt the producers act upon such opportunities.

Indeed, there are worrying examples of the development moving into the opposite direction. In the state of Washington, for example, the obligations of each producer are defined through a return share calculation. Within each independent plan or standard plan, however, the financial responsibility can be apportioned between the members according to other financial models than return share, such as market share. The operators of the Standard Plan (WMMFA[152]) in Washington approved in December 2007[153] a finance plan known as the "50-50". As of the Plan's first year of operation (2009), the state planned that half of the costs would be financed on the basis of market share, the other half on the basis of return share. Over the course of seven years, the calculation of all of the participating producers' costs in the Standard Plan would shift to market share.[154] According to some parties familiar with the Washington EPR system, this could be explained by the success of a specific new market entrant, whose contribution in a return share model was seen as unfairly small by other producers for the first years of operation.

In the alternative, Independent Plan scheme, the members would be responsible for the costs they incur to collect, transport and process their own branded electronics.[155] It is nevertheless expected that all manufacturers will participate in the Standard Plan for the first years of the program: the authorities have so far refused to authorize the operations of any of the proposed individual schemes. The reasoning usually is that the proposed private collection network does not meet the required "convenience standard" regarding the ease of takeback by users.[156] Overall, the Washington developments reflect a general trend of the pendulum swinging towards collective systems, with regrettably limited incentives on individual producers to design for the environment.

4.2 The shredder economy

There often seems to be a perceived trade-off between the optimization of design for environment incentives through the allocation of actual product costs to individual producers, on the one hand, and the complexity and efficiency of the takeback and recovery system, on the other. The trade-offs are clearest where the design-based differences in the producers' costs to manage WEEE are insufficient to have an impact on the strategic decisions of EEE producers. The trade-offs are likely to depend on the product type, market conditions and EOL treatment options at a specific moment in time.

One solution would be to identify cases where the recycling and recovery related treatment requirements could be made more detailed. The current practice appears to be to treat practically all recovered WEEE in a general process of material shredding (tearing the product mechanically into small parts for subsequent recovery of materials). Shredding the product generally

[151] 2008, 25.
[152] Washington Materials Management & Financing Authority.
[153] WMMFA Newsletter 2007.
[154] Washington State Department of Ecology 2009.
[155] The producers will also be responsible for their portion of the annual administrative fee payable to the Department of Ecology authorities. The fee is based on the market share of the manufacturer, consistent with the Standard Plan's 50-50 policy.
[156] Private communication with WMMFA 23.5.2011.

excludes dismantling, which means that opportunities for component recovery are decreased. This in turn reduces e.g. the amounts of scarce metals that may be recovered in comparison to more sophisticated recycling techniques.[157] The recycling rate of specialty metals used in electronics is only 1 per cent, compared with the rate of 50 per cent for common metals such as steel.[158] Although the difference may be explained by the quantity and accessibility of the materials in the product, the rates could be improved considerably. There may be less scope left to improvements in the end of life environmental performance of an EEE device through design, if all WEEE ends up in such a large scale, anonymous shredder. In other words, in the absence of adequate market signals, specifying more detailed end of life treatment requirements on WEEE could create further design incentives for EPR as well as the recovery technologies.[159] The companies' costs for following such requirements obviously need to be assessed in light of the predicted environmental benefits so as to ensure in advance the sufficient efficiency of any proposed measures. The vitality of the recovery sector in the EU and other areas that follow proper recovery requirements is essential.

Environmental protection could be improved by revitalizing the dynamics of the WEEE end of life market. The treatment requirements could used in doing this, making them potentially more specific, yet dynamic to encourage design innovation. They should also apply equally to any party that engages in recycling activities, whether an official PRO or not, to create a level playing field. All this calls for stricter enforcement measures.[160] Stricter recycling requirements could also directly address the meta-problem of resource availability, which is also a key aspect of the EU's 2020 Strategy, in particular as far as scarce metals are concerned.[161] The treatment standards would also create benchmarks to better prevent exports of WEEE to sub-optimal treatment in other countries.

V. Conclusions

This article has reviewed the allocation of responsibility among producers operating in EPR systems. The intent has been to ascertain prospects for and barriers to systems which generate incentives for design of environmentally-preferred products. Put another way, the question that has been entertained is whether and to what extent individual producer responsibility (IPR) is feasible. The article has used the EU's WEEE Directive as the principal case in point for this analysis, though examples are drawn from other countries and the implications are intended to inform understanding of IPR across the globe and across product categories. The article assumes that management of WEEE in most cases still constitutes a cost, not a profit. This may be changing, however, so that the premise needs to be verified in future research on WEEE.

The examples described in this article show that elements of IPR exist in a variety of EPR systems – for example under the Japanese SHARL and IT scheme, in the State of Maine in the U.S., in the ElectroG system in Germany, in Sweden and previously in ICT Mileu's system in the Netherlands. These examples do not establish that a complete and fully effective IPR system exists: the individual responsibility in the examples is partial and subject to certain limitations and deficiencies. Further, the analysis presented here does not address extensively questions of whether those systems generated design for environment or whether the systems were cost effective.[162] The goal, however, was to demonstrate that elements of workable policy approaches exist in practice – that IPR is not a chimera. While the analysis does not provide complete model or a recipe for IPR, it does identify issues and potential components of IPR that policy makers should consider as they pursue IPR.

The article presents a framework for the analysis of EPR, arguing that issues are better understood when they are distinguished according to

- whether they relate to the basic character of EPR regardless of policy design, implementation and locale (what we have labeled the conceptual aspect of EPR),
- whether they relate to higher levels of government versus those at lower jurisdictional levels, and
- whether they arise from decisions made during the practical implementation irrespective of legal requirements.

This categorization in our view both clarifies the issues and highlights the fact that – like many contemporary policy issues – EPR involves matters of multi-level

[157] Dismantling of PCs prior to recovering materials from their printed circuit boards increases considerably the levels of precious metal recovery (i.e., even when the components are not intended for reuse). The interests of different parties in the EEE value chain on this issue may diverge from one another and from the overall net benefit, that is, producers may oppose the reuse of their products because of lost sales. The regulator should – ideally – be working to realign these interests. (Rotter, 2010).

[158] UNEP 2010. See also Chancerel and Rotter (2009); Graedel *et al.* (2011).

[159] See also Huisman & Magalini (2007, 151) makes a more far reaching claim, stating that "the environmental room for improving the EOL phase of most mainstream [EEE] products is very limited".

[160] Huisman *et al.* (2006, 87).

[161] Europe 2020 Strategy.

[162] There is both the question of whether products were designed to reduce environmental impacts and whether the EPR/IPR systems can be shown to be the cause of such outcomes.

governance. The multi-level character makes policy coordination crucial and political consensus challenging.

A central theme in the analysis of concepts, challenges and possible remedies is that incentives for design for environment are not possible if the costs of EOL management that are assigned to producers under EPR are not differentiated in some fashion according to the environmental burden and/or cost that their products engender. Much of the analysis in the article focuses on how specific aspects of various laws and policies, the EU's WEEE Directive in particular, contribute to or hinder that sort of differentiation. In addressing the cost differentiation aspects, the goal was to prescribe certain specific remedies – but even more importantly to illuminate the nature and consequences of different choices.

5.1 Principal issues in creating design incentives through IPR

A number of questions on EPR and of the challenges of pursuing IPR were posed at the beginning of this article. The pioneering WEEE Directive was chosen as the primary example to analyse these questions. Some of these issues are resolved through the clarifications that the analysis herein provides. These include the difference between financial and operational responsibility and between collective and individual responsibility, as well as the transposition of the EU Directive by member states. For others, alternative solutions or mere ideas to be researched further have been contemplated, reflecting the belief that appropriate choices depend on the context and goals of the specific EPR system. These include responsibility for historical and orphan waste, mechanisms to deter free riding, the limits to retroactive responsibility, the utility of visible fees and financial guarantees. The core questions of the analysis as set out in Section 1.1 are next recapped in more detail.

Should each producer be individually responsible for the waste of its own products, only, or is collective responsibility acceptable or even inevitable? Clearly it is critical that the charges for end of life management borne by (individual) producers vary according to the burden that they place on an EPR system and by implication on society. Such individual producer responsibility (and the variation in costs and charges) has been established in for example Japan and the state of Maine. In the EU, IPR is mandated for *new* waste in Article 8.2 of the WEEE Directive,[163] but implementation of IPR has been limited because of vague or inaccurate transposition of the directive to national legislation or because certain authorities and producers have found collective takeback systems to be more attractive than individual ones. The examples described in this article indicate that IPR-friendly systems are possible.

The legal aspects of individual and collective responsibility represent a companion set of challenges. It is argued in this article that the current assignment of collective responsibility for orphan and historical waste may not be as straightforward as has heretofore been understood. Collective producer responsibility in legal terms as a form of joint responsibility is not as such incompatible with the idea of allocating the burden for the end of life management of products by the actual costs of individual products or brands. Indeed, it is advocated here that not only may the outright use of current market shares be an environmentally undesirable way to allocate the responsibilities, it may also be at odds with the general principles of tort law. The collective schemes should therefore move towards a model where the shares of responsibility are allocated on the basis of actual management costs of each producer's own products, unless and until the parties prove that such allocation would be untenable. The authorities should take actions to encourage the shift from market shares to the actual costs of each producer. This is particularly important in cases where a collective responsibility is applied on new waste due to a lock-in from the side of historical waste.[164] Indeed, according to the Recast WEEE Directive,[165] "[t]he Commission is invited to report, by 14 August 2015, on the possibility of developing criteria to incorporate the real end-of-life costs into the financing of WEEE by producers, and to submit a legislative proposal to the European Parliament and the Council if appropriate."

Should a producer be responsible for orphan products? The political reality is that, as far as the research here could reveal, all EPR systems allocate the cost of managing orphan products to those other producers that operate on the market, even though the connection between paying those costs and incentives for DfE are obscure. This jeopardizes the objectives underlying IPR by increasing the likelihood of adoption of overall approaches to EPR that are not conducive to IPR, that is, the threat to IPR is indirect. The justification and efficiency of this way of assigning the costs of orphans depends in particular on the amount of orphans on the market. Experience from e.g. WEEE takeback and recovery in Maine indicates that the cost of orphans may in fact be quite limited in a particular market. In *these* cases it could be most efficient to allocate the cost of orphans partly *pro rata* on existing producers, partly on the society. The alternative in the EU, for example, is a complicated guarantee and registration system that would prevent orphans from emerging, and/or to at least have funds available to manage them. In case of limited orphans, this solution appears unnecessarily onerous. The analysis here also

[163] Article 12(2) in the Commission's Proposal to Amend the WEEE Directive COM(2008)810.

[164] I.e., "future waste" in the terminology of the WEEE Directive.

[165] Article 12(6), Recast WEEE Directive.

put forward that it may be legally problematic to charge existing producers in a system of individual responsibility for managing the end of life products that are not of the producer itself. The full application of collective responsibility to orphans does not seem to offer a good solution, either. It may create a lock-in effect to collective responsibility for all other (i.e. non-orphan) waste, which would put the design incentive structures for all new waste in jeopardy for very limited benefit.

Should the producer have both financial and operational responsibility? The issues here are revealed to be primarily matters of confusion. In particular, it is noted that delegation of the *execution* of operational activities associated with EPR should not be confused with assignment of operational responsibility. The article also argues that there should be a connection between operational and financial responsibility so that the parties bearing costs have the ability to take action to control those costs.

In this context, the debate over the use of visible fees emerges as somewhat of a red herring insofar as the incidence of payment rarely really reflects which party actually in the end bears the costs. Whether the financing initially takes place by absorbing recycling costs into profit margins to maintain pre-existing product prices, or by increasing prices to consumers, may not be of consequence. The entity that bears the ultimate burden of those costs depends on the structure of the market in which the producers and consumers are interacting. More important, according to this analysis is the fact that visible fees tend to be uniform across producers. They thus run counter to the key requirement of competition upon ecological design qualities: that the fees charged for EPR vary to the extent that end of life management costs vary.

Should producers be responsible for historical waste? As with orphan waste, responsibility for historical waste has been assigned to producers irrespective of the connection to DfE incentives. The establishment of the distinction in the WEEE Directive between the historical and future wastes has led in many EU member states to situations where the costs of future waste are managed in the same fashion as those for historical waste – according to market share; thus, in practice all WEEE is managed as historic waste, thereby diminishing the incentives for DfE. On the one hand, as the proportion comprised by historical waste declines, the financial impact of the rules used to allocate the costs for historical waste should become less and less significant. On the other, the extension of cost allocation by market share to all categories of WEEE threatens obviate the possibility for incentives for DfE – what we have called "lock-in." Both facts should lead to abolishing the distinction between various historical and future waste as soon as the diminished amounts of the historical waste in question permit that. Jurisdictions that are still considering their approach to historical waste should finance the recovery from general tax revenues rather than apply collective producer responsibility. Not only would difficult issues of retroactivity be side-stepped, the solution would also avoid locking *new* waste into a collective system that lacks proper design incentives.

5.2 Of IPR Elements and Elephants

In addition to a more accurate conceptualization along the lines highlighted above, there are numerous elements that a proper IPR system should include. This analysis revealed many such IPR elements in takeback and recovery systems in various countries. Amongst the elements, there are a number of meta-issues, which are plain obvious to everyone, yet which the discourse has up until recently carefully avoided: true "elephants in the room" as the proverb has it.

An accurate apportionment of recycling costs to each producer necessitates conceptual clarity and a rigorous legal framework, but also the practical means to distinguish products. This way the products receive optimal physical treatment and an accurate accounting of the costs per producer can take place. Both are prerequisites for creating the necessary incentives for design for the environment. A more careful analysis of the experiences from the Dutch ICT Milieu seem to question the prevailing wisdom that manual identification would be prohibitively expensive. In addition, the tracking system of the Japanese SHARL, the sampling in, e.g., Washington state and, perhaps, the long-awaited deployment of RFID technology could further facilitate the identification, and thus the separation, of products.

On the other hand, the creation of efficient takeback and recovery systems necessitates functioning competition throughout the life cycle of the products, including the recycling phase. The Japanese SHARL is an example of a scheme where such competition could exist between the recycling facilities of the two competing takeback Groups A and B. The efficiencies in SHARL have not been a trade off with design incentive structures, either: there are direct economic and informational links between the producers' design departments and the recycling processes, in particular in Group B where the producers are vertically integrated in the recycling.

The Swedish vehicle and WEEE insurance schemes provide examples of how a collective arrangement may incorporate elements of individual responsibility. The Swedish systems operated centrally but were planned to take into account and encourage proper design for the environment at the level of individual products. The approach has evolved in a recent French law[166] that implements the WEEE Directive. The Decree requires WEEE compliance schemes in France to charge producers pre-determined compliance fees that are to be differentiated on the basis of six easily identifiable,

[166] Article 5 of Decree no 2005—829 of 20 July 2005.

(un)desirable end-of-life design characteristics of products. For example, a display screen with backlights that contain mercury and plastics with brominated flame retardants faces a fee that is raised by 20 per cent. This solution strives to strike a balance between introducing design incentives and maintaining simplicity and opportunity for economies of scale and scope. Mayers *et al.*[167] have gone yet a step further by proposing a system that differentiates various groups of products ("treatment categories") in function of their key recycling characteristics. The products' recycling and treatment fees are then based on the actual costs of their "treatment categories". This kind of a mechanism would improve the systems' financial continuity and equitability. It would seem that the next step in this approach is to think of clever ways of choosing the key design characteristics, so as to identify the most feasible aspects without deterring environmental innovation on other (environmental) characteristics of the products. The party determining such characteristics would need to be carefully defined, in particular to avoid parochial favouritism from creeping into the standards.

Particular challenges lie in the recycling and treatment process technologies for end of life WEEE. Member State enforcement of these activities could certainly be improved. The current omnipresence of shredding is particularly disconcerting. Shredding means in practice a bulk treatment of WEEE. Shredding is a big elephant in the room, because individual product characteristics often become of little consequence. The public authorities need to assess whether to react by encouraging design incentives for EPR through stringent end-of-life processing requirements. Some stakeholder groups actively pursue the matter, and the Recast WEEE directive already prepares for such developments. It states[168] that the best available treatment, recovery and recycling techniques may be further defined in accordance with the procedures of the Directive on integrated pollution prevention and control (IPPC).[169] The requirements should be applicable widely to assure an equally high level of environmental protection as well as proper competitive conditions to drive process innovation in this field further. They should better take into account the differences in the types of products.[170] This in turn necessitates a more detailed assessment and statement of the ultimate goals to be achieved through EPR: is it hazardous waste elimination, minimization of air and water pollution, reduction of green house gases, a high level of materials recovery in general, scarce metals recovery, component reuse, landfill management, litter policy, or something else? The first goal seems unnecessarily dominant in today's policies. Without a correct and sharp focus, the environmental intent of EPR is easily confused.[171]

The issue of proper treatment standards is intrinsically linked to external relations, because so much of WEEE and other valuable waste in developed countries is currently escaping proper treatment as it is exported to developing countries. The producers cannot reap the benefits of their design-for-recycling investments. This is a great threat to IPR, yet it is only a part of the environmental problem. The waste is often diverted away from producer take-back schemes and ends up in atrocious treatment conditions in the developing countries in Africa and Asia. In the EU, preventing the leakage of wide scale streams of WEEE would require a fundamental scrutiny of the Member State enforcement authorities' role, resources and motivations. In addition, as is highlighted in the Europe 2020 strategy,[172] resource scarcity is a further high-level issue to be reckoned in this context. With the WEEE streams, a considerable amount of specialty metals is escaping recovery. The multiplying effect is that the inability to recover the metals with sophisticated recycling technologies in Europe and elsewhere will create even further strains on the world's limited natural resources. This often happens in environmentally and socially very fragile regions. The issue is another enormous elephant in the room. More detailed information on the sizes, contents and destinations of current WEEE streams is therefore required.[173] In fact, the question is as much about the absence of data as it is about making proper use of it. The implementation of the latest technological solutions may help in achieving this. The more detailed reporting requirements, such as SHARL-type recycling manifests on all participating parties (not just the producers) might provide an option worth investigating further.

5.3 Public sector interventions across the levels of governance

Finally, in addition to a more accurate conceptualization and an analysis of elements critical to a proper individual producer responsibility system, the challenge ahead is also on how these concepts and elements may be optimally and practically combined. An IPR framework needs to stretch coherently across the different levels of governance from the practical implementation of PROs and municipalities to states and the federal/regional level, and beyond to the international fora. It is challenging to maintain the financial incentive structure of EPR across the levels. Public sector intervention is needed at the points

[167] Forthcoming. The model also balances PRO costs against revenues and provides for guarantees.
[168] Recital 17, Recast WEEE Directive.
[169] 2008/1/EC; European Commission 2011.
[170] Huisman *et al.* (2006, 86).
[171] *Ibid*, 84.
[172] Europe 2020 Strategy.
[173] Projects such as the Massachusetts Institute of Technology's Trash Track project offer interesting insights to latest developments (see http://senseable.mit.edu/trashtrack/).

described above, but needs to be done coherently, in collaboration across the policy levels. This step is far ahead. Even within the EU, for example, the Member State transposition of the EU IPR requirements is as poor. Directly applicable and effective EU level harmonization in the form of a regulation could be useful,[174] but would need to be more precise in defining the responsibilities than so far: some of the problems originate from the WEEE Directive's text.

At the most fundamental level, the question reverts back to the *raison d'être* of IPR. Has the original objective of creating design incentives turned, at some level of governance, into a much simpler and tangential aim of finding deep pockets outside the constrained public sector budgets? What about the fundamental hierarchy of waste management:[175] have the design-for-environment incentives of IPR, which promote prevention as the highest level of waste management hierarchy, been downgraded by some authorities to mere collective recycling and waste management systems? And not just in the general waste policy debate,[176] but in written waste *law*?

For companies seeking efficient IPR infrastructures, the multilevel environment highlights the importance of strategic thinking. In some cases the political and economic lock-in to the collective producer responsibility is so tight, that the IPR elements will need to be combined with it. These challenges are considerable; they must be faced vigorously. The elephants in the room – in particular resource scarcity and the deterioration of the environment in the developing countries due to WEEE – only underline the importance of achieving more and more properly functioning producer responsibility to drive a greener economy.

VI. Bibliography

Atasu, A. & Subramanian, R. 2011. Extended Producer Responsibility for E-waste: Individual or Collective Responsibility? Production and Operations Management, forthcoming.

Atasu, A. and Van Wassenhove, L. N. 2011. An Operations Perspective on Product Take-Back Legislation for E-Waste: Practice, Trends and Research Needs, Production and Operations Management, 2011, forthcoming.

Atasu, A., Van Wassenhove, L. N., & Sarvary, M. 2009. Efficient Take-Back Legislation. Production and Operations Management. 18(3): 243-58.

Bell, Stuart and Donald McGillivray. 2008. Environmental law. New York: Oxford University Press.

Black's Law Dictionary. 2009. Bryan A. Garner, editor in chief. 9th Edition. St. Paul: West Publishing Co.

BGBII (Bürgerliches Gesetzbuch, Germany) (§830(1))

Cahier des charges annexé à l'agrément d'un organisme délivré en application des articles R. 543-189 et R. 543-190 du code de l'environnement. Ministère de l'écologie, du développement durable, des transports et du logement. Ministère de l'écologie, du développement durable, des transports et du logement.

Case No: CO/1934/2009, the High Court Of Justice, Queen's Bench Division, Administrative Court: 31/07/2009. [2009] EWHC 2015 (Admin)

Case 10/85, *Milac GmbH, Gross- und Aussenhandel v. Hauptzollamt Lörrach*, (1986) ECR 1027.

Case C-13/92 to C-16/92, *Driessen and others v. Minister van Verkeer en Waterstaat* (1993) ECR I-4751

Case 17/67 *Firma Max Neumann v. Hauptzollamt Hof/Saale* (1967) E.C.R. (English edition) 441

Case 21/81 *Criminal proceedings against Daniël Bout and BV I. Bout en Zonen* (1982) E.C.R. 381

Case 98/78 *Racke v. Hauptzollamt Mainz* (1979) E.C.R. 69.

Case 100/63 *J.G. van der Veen, widow of J. Kalsbeek v. Bestuur der Sociale Verzekeringsbank and nine other* cases (1964) E.C.R. (English edition) 565

Case 368/89, *Antonio Crispoltoni v. Fattoria autonoma tabacchi di Città di Castello* (1991) E.C.R. I-3695.

Castrén, Helena. Senior Environment Manager, Nokia Corporation. Interview 25.2.2010.

CECED. 2004. Electronic Product Identification. A Study into the feasibility of technologies that enable the identification of producer and product characteristics. Study Submitted to CENELEC BT Task Force BTTF 116-3, September 2004.

Chancerel, Perrine and Rotter, Vera Susanne. 2009. Stop wasting gold – How a better mining of end-of-life electronic products would save precious resources. Conference article presented at the World Resources Forum, 16 September 2009, available at http://ewasteguide.info/files/Chancerel_2009_R09.pdf

Code Civil (France), Article 1384(1) C.Civ,

Commission of the European Union. 2011. Report on the Thematic Strategy on the Prevention and Recycling of Waste, COM (2011) 13 final.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA"), U.S.C. §§ 9601-9675.

Cook v. Lewis [1951] S.C.R. 830 (1951) Supreme Court of Canada

Cronin, E., P. Sweeney, S. Hickey, and C. Fitzpatrick. 2009. Developing RFID signalling to close the loop on second hand computers. Article presented at 2009 IEEE International Symposium on Sustainable Systems and Technology, ISSST '09 in Cooperation with 2009 IEEE International Symposium on Technology and Society, ISTAS, Tempe, AZ.

[174] Huisman & Magalini (2007, 154).

[175] See for example Articles 3(12) and 4 in EU's new Waste Framework Directive (2008/98/EC).

[176] See e.g. the EU's Thematic Strategy for Prevention and Recycling of Waste, COM(2005)666 tai 667).

Greening the Economy through Design Incentives

Deakin, Simon F. 2003. Markesinis and Deakin's Tort Law, 5th Ed. Clarendon Press: Oxford.

Dempsey, Mark & van Rossem, Chris & Lifset, Reid & Linnell, Jason & Gregory, Jeremy & Atasu, Atalay & Perry, Jonathan & Sverkman, Anders & Margetson, Gregor & van Wassenhove, Luk & Therkelsen, Martin & Sundberg, Viktor & Mayers, Kieren & Kalimo, Harri. 2010. Individual Producer Responsibility: A Review of Practical Approaches to Implementing Individual Producer Responsibility for the WEEE Directive. INSEAD Faculty and Staff Working paper 2010/71. INSEAD: Fontainebleau.

Directive 2002/96/EC of the European Parliament and of the Council on Waste Electrical and Electronic Equipment, OJ L [2002] 37/24, as amended. ("WEEE Directive")

Directive 2012/19/EU of the European Parliament and of the Council on Waste Electrical and Electronic Equipment (WEEE) (recast), OJ L [2012] 197/38. ("Recast WEEE Directive")

DTI. 2005. Waste electrical and electronic equipment (WEEE): innovating novel recovery and recycling technologies in Japan. Report of a DTI Global Watch Mission, September 2005.

Electrolux Ab, Braun, European Environmental Bureau, Greenpeace International, Hewlett Packard, Länsförsäkringar Insurance, Sony Europe, Stena Technoworld AB (2007) Developing Practical Approaches to Individual Producer Responsibility. Presentation at the INSEAD IPR Workshop, Fontainebleau, 25 October 2007.

ElektroG. Elektro- und Elektronikgerätegesetz vom 16. März 2005 (BGBl. I S. 762), das zuletzt durch Artikel 5 des Gesetzes vom 11. August 2010 (BGBl. I S. 1163) geändert worden ist.

European Commission. Environment. Environmental Technologies Action Plan. http://ec.europa.eu/environment/etap/inaction/showcases/eu/740_en.html (Accessed 11.7.2011)

Environment Daily (2002) "Firms, NGOs and consumers in WEEE plea," 15.2.2002, on subscription http://www.environmentdaily.com.

European Parliament legislative resolution of 3 February 2011 on the proposal for a directive of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE) (recast) (COM(2008)0810)

Europe 2020 Strategy. Communication from the Commission. A strategy for smart, sustainable and inclusive growth. 3 March 2010. COM 2010(2020) final.

Final 2011 Orphan Brand Returns. 2011. Washington State Electronic Products Recycling Program. May 31 2011. Available at http://www.ecy.wa.gov/programs/swfa/eproductrecycle/docs/Final2011OrphanBrandReturns.pdf

Final Report. 2010. Supporting the Thematic Strategy on Waste Prevention and Recycling. Institute for European Environmental Policy (IEEP), Ecologic, Arcadis, Umweltbundesamt, Bio Intelligence Services and Vito. 25 October 2010.

French Decree No 2005-829 on the Management of WEEE (Waste Electrical and Electronic Equipment) (Décret no 2005-829 Gestion des DEEE (Déchets Electriques et Electroniques)), JO no169 du 22/07/2005.

Future Energy Solutions (2003) Study Into European WEEE Schemes. Prepared for Department of Trade and Industry, 20 November 2003. (Available at: www.bis.gov.uk/files/file30305.pdf)

Graedel, T. E., J. Allwood, J.-P. Birat, M. Buchert, C. Hagelüken, B. K. Reck, S. F. Sibley, and G. Sonnemann. 2011. What Do We Know About Metal Recycling Rates? Journal of Industrial Ecology 15(3): 355-366.

GreenPeace. 2008. www.greenpeace.org/intenrational/campaigns/toxics/electronics/philips/individual-producer-responsibi/ (Visited: October 2010)

Gui, L., Atasu, A., Ergun, Ö., Toktay, L. B., 2011. Fair and Efficient Implementation of Product Take-Back Legislation with Collective Producer Responsibility. Georgia Tech Working Paper 2011.

Enagagements Annexés à l'agrément d'un organisme coordonnateur deliver en application de l'article 9 du décret no2005-829 du 20 juillet 2005 relatif à la composition des équipements électriques et électroniques et à l'élimination des déchets issus de ces équipements. Ministère de l'écologie, du développement durable, des transports et du logement.

Hischier, R., Wäger P. and Gauglhofer, J. 2005. Environmental Impact Assessment Review, Volume 25, Issue 5, July 2005, 525-539.

Huisman, J., Magalini, F. 2007. Where are WEEE now? Lessons from WEEE: Will EPR Work for the US? Isee: 149-154. Proceedings of the 2007 IEEE International Symposium on Electronics and the Environment.

Huisman, J., Magalini, F., Kuehr, R. & Maurer, C. 2007. 2008 Review of Directive 2002/96 on Waste Electrical and Electronic Equipment (WEEE). Final Report. Bonn: United Nations University.

Huisman, J., Stevels, A., Marinelli, T. and Magalini, F. 2006. Where did WEEE go wrong in Europe? Practical and academic lessons for the US. ISEE, pp. 83-88, Proceedings of the 2006 IEEE International Symposium on Electronics and the Environment.

HR, 9 October 1992, NJ 1994, 535.

IPR Workshop. Institute for European Studies, Vrije Universiteit Brussel (VUB). Plenary discussion. January 13 2011.

Kalimo, Harri. 2004. Recycling Electronics–At the Crossroads of Contemporary Environmental and Free Trade Law. Harri Kalimo: Turku (Finland) (LL.D. Dissertation)

Kalimo, Harri. 2006. E-CYCLING. Linking Trade and Environmental Law in the EC and the U.S. Ardsley: Transnational Publishers.

Kalimo, H., Lifset, R., van Rossem, C., van Wassenhove, L., Atasu, A., and Mayers, K. (Forthcoming) Greening Electronics through Design Incentives: What Roles for which Stakeholders under Extended Producer Responsibility?

Lifset, Reid. 1993. Take it Back. Extended Producer Responsibility as a Form of Incentive Based Environmental Policy. Journal of Resource Mangement and Technology 21(4), 163-175.

Lindhqvist, T. 1992. Extended Producer Responsibility. In T. Lindhqvist, Extended Producer Responsibility as a Strategy to Promote Cleaner Products (1-5). Lund: Department of Industrial Environmental Economics, Lund University.

Lindhqvist, Thomas. 2000. Extended Producer Responsibility in Cleaner Production. Lund University: Lund.

Lindhqvist, T, and Lidgren, K. 1990. Modeller för förlängt producentansvar [Models for Extended Producer Responsibility]. In Ministry of the Environment, Från vaggan till graven – sex studier av varors miljöpåverkan [From Cradle to Grave – Six studies on the environmental impact of products], (7-44). Ds 1991:9.

Lindhqvist, T. and R. Lifset. 2003. Can we take the concept of individual producer responsibility from theory to practice? Journal of Industrial Ecology 7(2): 3-6.

Magalini, F., Huisman, J., Stevels, A., and Marinelli, T. 2006. The implementation of WEEE Directive: Present status and future options for development and simplifications. Conference paper presented at Going Green Care Innovation Conference, Vienna, 13.11.2006

Maine Revised Statutes Annotated, Title 38, Chapter 16 (Sale of Consumer Products Affecting the Environment)

Mayers, Kieren. 2007. Strategic, Financial, and Design Implications of Extended Producer Responsibility in Europe: A Producer Case Study. Journal for Industrial Ecology 11(3): 113-131.

Mayers, Kieren. 2010. Electronics Takeback – A Failure of EPR? Presentation at the INSEAD IPR Workshop, Paris, February 25 2010.

Mayers, Kieren & Reid Lifset & Karl Bodenhöfer & Luk van Wassenhove (forthcoming) Implementing Individual Producer Responsibilty for Waste Electrical and Electronic Equipment through Improved Cost Allocation. *Journal for Industrial Ecology*.

Mayers, K., R. Peagam, C. France, L. Basson, and R. Clift. 2011. Redesigning the Camel. *Journal of Industrial Ecology* 15(1): 4-8.

NERIC. 2011. Current Electronics Recycling Laws in Effect, available at http://www.ecyclingresource.org/ContentPage.aspx?Pageid = 28&ParentID = 0

OCAD3E (Organisme Coordinateur Agréé pour les Déchets d'Equipements Electriques et Electroniques). Note technique. Application des Critères de Modulation de la Contribution Environnemental. V1.3 du 18 juin 2010.

OECD. 2001. Extended Producer Responsibility. A Guidance Manual for Governments. (OECD: Paris, 2001).

Parlikad, A. K. and D. McFarlane. 2007. RFID-based product information in end-of-life decision making. Control Engineering Practice 15(11): 1348-1363.

Private communication with WMMFA 23.5.2011.

Reina, Kimmo. 1999. Tuottajavastuu erityisesti pakkausjätteiden jätehuollossa. (Producer responsibility, in particular in the management of packaging waste.) Ympäristöoikeudellisia Tutkielmia. Suomen ympäristöoikeustieteen seura: Helsinki.

Rotter, Susanne. 2010. IPR Implementation Challenges: The case of Germany. Presentation at the INSEAD IPR Workshop, Paris, February 25 2010.

Sander, K., S. Stephanie, N. Tojo, C. van Rossem, J. Vernon, and C. George. 2007. The producer responsibility principle of the WEEE directive DG ENV. Study Contract No. 07010401/2006/ 449269/MAR/G4. Hamburg, Germany: Ökopol Gmbh.

Skumatz, Lisa A. & Truitt, Erin & Green, John. 1997. The State of Variable Rates: Economic Signals Move into the Mainstream. Resource Recycling, December (1997), at 29–35.

Stevels, Ab, 2001. Experiences With the Take-Back of White and Brown Goods in the Netherlands. In: EcoDesign 2001: Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing, at 489–493. IEEE: Los Alamitos (Ca.)

Sundberg, Viktor. Vice President, Electrolux Corporation. Interview 14.1.2011.

Superfund Amendments and Reauthorization Act of 1986 ("SARA"), 42 U.S.C. §§ 9601–9675.

Sverkman Anders. 2010. Financial Guarantees as a Trigger for IPR. Presentation at the INSEAD IPR Workshop, Paris 25 February 2010.

Tojo, Naoko. 2004. Extended Producer Responsibility as a Driver for Design Change – Utopia or Reality? Lund University: Lund.

Tojo, N. 2006. EPR Programme for EEE in Japan: Brand Separation? In: INSEAD WEEE Directive Series, 30 November 2006.

UNEP. 2010. International Panel for Sustainable Resource Management. The Recycling Rates of Metals: A Status Report. Paris: UNEP.

University of Tokyo Develops New Technology to Recover Rare Earth Metal from Scrap Magnets. http://www.japanfs.org/en/pages/030648.html; http://www.japanfs.org/en/pages/029912.html; http://www.japanfs.org/en/pages/029912.html

Van Gerven, Walter & Jeremy Lever & Pierre Larouche. 2000. Tort Law. Cases, Materials and Text on National, Supranational and International Tort Law. Hart: Oxford.

Van Rossem, Chris. 2008. Individual Producer Responsibility in the WEEE Directive. From Theory to Practice? IIIEE: Lund.

Greening the Economy through Design Incentives

Van Rossem, Chris, Tojo, Naoko & LIndhqvist, Thomas. 2006. Lost in Transposition? A Study of the Implementation of Individual Producer Responsibility in the WEEE Directive. Report Commissioned by Greenpeace, Friends of the Earth and the European Environmental Bureau. IIIEE: Lund.

Washington Administrative Code, Title 173, Chapter 173-900, (Electronic Products Recycling Program).

Washington State Department of Ecology (2009) Establishing a Return Share List (http://www.ecy.wa.gov/programs/swfa/eproductrecycle/returnShare.html; accessed on 20 December 2009.

WMMFA (Washington Materials Management & Financing Authority) Newsletter. 2007. "Authority Finance Plan Approved," 13.12.2007, available at wmmfa.net/documents/pdf/newsletters/E-Newsletter_12_13_07.pdf

Annex 1

1. Benchmarked EPR Systems

This Annex offers capsule summaries of seven EPR programs for the management of WEEE. These programs have elements that are of particular relevance to the question of effective incentives for design for environment. Various elements of IPR-based systems have been achieved, for example, through an innovative design of the legislative framework itself or through the way in which producers have implementfed their responsibility under the law. Specific, practical examples from each scheme are used in the paper to highlight different elements of EPR schemes.

SHARL, the Specified Home Appliances Recycling Law, was enacted in Japan in 1998 and came into force in April 2001. SHARL's scope is limited to six large home appliances including TV sets, cooling devices, washing machines, air conditioners, clothes dryers and flat screen TVs. Under the law, the producers of these household appliances are required to take back their discarded products, dismantle them and meet reuse, recycling and recovery targets of 50 per cent – 60 per cent. Treatment standards for printed circuit boards and cathode ray tubes (CRT) in TV sets were later mandated through a revision of the Waste Management Law.[177] SHARL employs a manifest tracking system to follow products through their life-cycles, as well as to link the producers to the evolving recycling requirements.

Japan's Law for Promotion of Effective Utilization of Resources (often referred to as the Recycling Promotion Law) was enacted in 1991. The Japanese IT scheme aims to promote the recycling of a variety of products and materials. The law specifically notes the promotion of product designs for waste reduction, recycling, and reuse as one of its objectives. The revised version of the law embraces the principle of extended producer responsibility (EPR) as it requires manufacturers to establish collection and recycling systems for used computers. The recycling of PCs discarded by households has been required since October 2003.[178]

ICT Milieu is one of two collection systems for WEEE in the Netherlands. ICT Milieu collects information technology, communications and office equipment, including for example printers and telecommunication devices. The alternative organisation in the Netherlands to collect and manage WEEE, specifically white and brown goods,[179] is NVMP. ICT Milieu was formed when producers in the sector decided to fulfil their legal obligations through a voluntary PRO. ICT Milieu was operated until end of 2002 on the basis of a return-share financial model: each producer had a retrospective responsibility for all their own branded products collected by the system. The contents of every container delivered to the recycling company used by the system, MIREC, was manually identified. Each product was weighed on a scale so as to allocate the costs according to the weight of each producer's products. However, from the beginning of 2003, the financing system based on actually recovered waste was changed to an allocation of costs based on the current market shares.

Maine and *Washington* were the first amongst the 20 US states and one municipality (New York City) that had by May 2011 enacted product take back or product stewardship legislation.[180] Numerous other states have proposals under preparation. Maine[181] and Washington[182] both have elements of IPR-based systems mandated for WEEE in their legislation. *Maine's* legislation[183] sets up a return share based system of product takeback: manufacturers are individually responsible for the costs of handling and recycling household-generated waste computer monitors and televisions of their brand once they are received at a consolidation facility in the state. It is notable that promoting improvements in the design of electronic products is explicitly mentioned as a key aim in the Maine legislation. The law was enacted in 2004, and the system has been in operation since 2006. Legislation in the state of *Washington*[184] is similar to

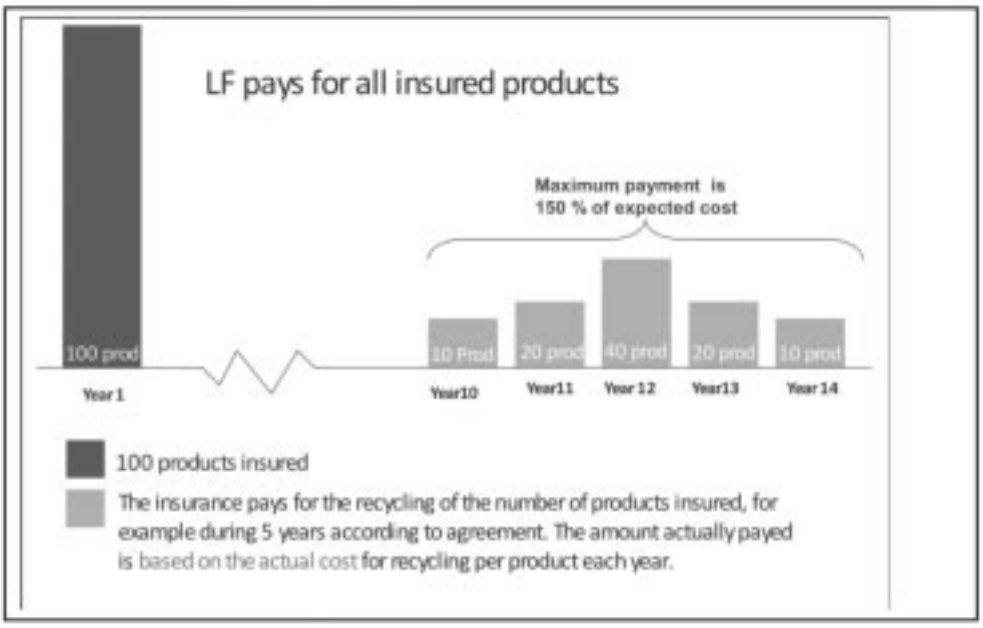
[177] Tojo 2004.
[178] Dempsey *et al.* 2010, 17-18.
[179] White goods refer to large household electrical appliances that are used for common household activities such as washing and food storage. Brown goods is a term used for household electrical entertainment appliances.
[180] NERIC, 2011.
[181] www.maine.gov/dep/rwm/solidwaste/index.htm
[182] http://apps.leg.wa.gov/RCW/default.aspx?cite=70.95N&full=true
[183] Maine Revised Statutes Annotated, Title 38, Chapter 16.
[184] Washington Administrative Code, Title 173, Chapter 173-900.

that in Maine. The Washington law (2006) is based on a standard recycling plan, which is the default option for producer compliance. Manufacturers may also start an independent plan on their own or with others, if the (combined) return share is above 5 per cent of e-waste.

The *Bosch-led Power Tool Take Back Consortium* in Germany is a take back and recycling program for power tools and their portable batteries in Germany. This program has had two distinct phases of development: first a voluntary initiative, then an adaptation of the programme to the legal requirements of the German transposition of the WEEE Directive, the Act Governing the Sale, Return and Environmentally Sound Disposal of Electrical and Electronic Equipment (ElektroG).[185] In Phase 1 (1993-2005), 22 brand owners, representing approximately 80 per cent of power tool market, and led by Bosch Power Tools developed and operated a voluntary program to fulfil their anticipated legal obligations. The system was independent of any national compliance scheme that may have existed in parallel.[186] After the introduction of the ElektroG in 2005, the programme was expanded in Phase 2 to include the collection of power tools at municipal collection facilities. Each producer is responsible for the percentage of total WEEE collected that equals its market share that year.

A recycling insurance system, that was initially set up for car manufacturers in Sweden in 1998, is the final example of practical IPR-based systems. Five car manufacturers provided, through an insurance company, a long term 30-year financial guarantee to cover the future cost of recycling of each car that they produced. Länsförsäkringar, a Swedish insurer, offered a modified version of the above solution for producers that are responsible for WEEE on the Swedish market. The WEEE insurance solution offers a financial guarantee, yet unlike the scheme for vehicles, does not arrange for the physical management of the customers' WEEE. The new model for recycling insurance is available to both individual producers and groups of producers (in a collective system, for example) to satisfy the requirements set in Swedish legislation on WEEE. The insurance thereby eliminates the risk of producers becoming free riders in the system. In terms of this paper, there are two further aspects to this solution that are interesting: (i) it promotes eco-design: the easier a ELV is to recycle, in theory, the lower is the premium (ii) it protects against increases in the future recycling costs, thus reducing the uncertainty of the society as well as the producers.

Figure 2 below illustrates the situation.



Source: Anders Sverkman, Länsförsäkringar AB.

[185] ElektroG. Elektro- und Elektronikgerätegesetz vom 16. März 2005 (BGBl).
[186] Dempsey *et al*. (2010, 42-43).