

The Economics of Electronics Recycling: New Approaches to Extended Producer Responsibility

by Philipp Bohr

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To claim that the manufacturers of electronics and electric equipment (“EEE”) have succeeded in implanting technology into every aspect of modern life would be an understatement. According to the U.S. Environmental Protection Agency, sales of personal computer and peripheral equipment have increased from fewer than one million of each product annually in 1980 to between thirty and forty million of each product annually in 2007.¹ The number of televisions sold in the U.S. nearly doubled between 1980 and 2000,² when the population only increased by approximately 24%.³ Further propelling the growth of electronics sales is the increasing American thirst for technology improvements illustrated by the fact that every person in the United States buys a new mobile phone every two years.⁴

Currently, environmental authorities around the world are showing concern about the proliferation of EEE because of stress on landfill capacity and the rapidly increasing volume of

¹ The U.S. Env'tl. Protection Agency Office of Solid Waste, Electronics Waste Management in the United States: Approach 1 9 (EPA530-R-08-009, 2008), *available at*

<http://www.epa.gov/epawaste/conserves/materials/ecycling/docs/app-1.pdf> [hereinafter E-Waste] (Table 2.2). Personal computer and peripheral equipment is defined as desktop and portable computers, hard copy peripherals (printers, faxes, etc.), mice, keyboards, CRT monitors, and flat panel monitors. *Id.* Desktop computers and CRT monitors were the only two categories with declining sales numbers in the past decade but growth of portable computers and flat panel monitors correlate directly with the decline. *Id.*

² *Id.* at 8 (Table 2.1).

³ Frank Hobbs and Nicole Stoops, U.S. Dep't. of Commerce, U.S. Census Bureau, Demographic Trends in the 20th Century: Census 2000 Special Reports 11 (2002), *available at* <http://www.census.gov/prod/2002pubs/censr-4.pdf> [hereinafter Census] (Fig. 1.1).

⁴ E-Waste, *supra* note 1 at 8 (Table 2.1); Census Bureau Home Page, Population Clock, <http://www.census.gov> (last visited October 26th, 2008). The US census website estimates that there are over 305,000,000 people in the country and Environmental Protection Agency data shows that, since 2005, over 150,000,000 million mobile phones were sold annually.

hazardous materials exposure.⁵ Traditionally, the issue of landfill volume and hazardous waste disposal has been steered by municipalities that manage waste collection and disposal or environmental policy makers and regulators.⁶ However, the nature of disposal of EEE is so dependant on product design that initiatives have commenced to assign legal responsibility for waste management to the manufacturers of high-tech hardware.⁷ In undertaking a review of this doctoral thesis, I sought to answer the question: How do EEE manufacturers, whose environmental liabilities previously matched those of any generic manufacturing operation, adjust to management of environmental hazards at the end of a product's life? In *The Economics of Electronics Recycling: New Approaches to Extended Producer Responsibility*, Phillipp Bohr⁸ provides an economic analysis of various legal and policy vehicles to promote environmentally responsible design and disposal of EEE. He specifically focuses on extended producer responsibility ("EPR") schemes for waste electronics and electrical equipment ("WEEE"). Although Bohr's research has a primarily economic tone, his conclusions provide a foundation for future discussion between lawmakers, policymakers, and the EEE manufacturers facing a potential source of additional liability.

⁵ See generally E-cycling: Common Wastes and Materials: US EPA <http://www.epa.gov/epawaste/conserva/materials/ecycling/index.htm> (last visited on October 26, 2008) (Consumer information site designed to demonstrate the US government's concern with E-Waste disposal. More detailed statistics about the threat contained within the network of hyperlinks.)

⁶ Matthew Bender & Co., 1-1 Treatise on Env'tl. Law, §1.03 (2007).

⁷ Philipp Bohr, *The Economics of Electronics Recycling: New Approaches to Extended Producer Responsibility* 47-48 (2008). Governing bodies in Germany, Switzerland, the Netherlands, Belgium, Norway and Sweden individually and, later, the European Union collectively passed laws assigning responsibility for waste management to EEE manufacturers. *Id.* In North America, California, Maine, Maryland, Massachusetts, Minnesota, Alberta, and Ontario have passed some producer responsibility laws and the United States legislature has proposed a number of bills although none have been successful. *Id.*

⁸ Philipp Bohr received his Ph.D. from Technischen Universität Berlin and researched environmentally benign manufacturing as a visiting scholar at the Massachusetts Institute of Technology. He is currently working on projects in climate protection and waste management in Switzerland.

Bohr's thesis describes the basic components of EPR systems, analyzes existing EPR approaches (particularly those in place in Europe⁹), and suggests an alternative EPR approach to alleviate some of the identified shortcomings of those EPR policies already in place. Section two is an overview of the basic elements of an EPR system and a detailed explanation of how the author devised the system models used to draw his conclusion. This in-depth academic economic analysis will not likely be of interest to a legal or policymaking audience, but those who wish to better understand the research methodology may find it informative. The primary benefit the section will provide for such readers is a step-by-step description of EPR's stakeholders and operational mechanisms. Attorneys, particularly those retained by EEE manufacturers, who will be responsible for mitigating client risk in the otherwise uncharted territory of end-of-life waste management, will need to endure the lengthy descriptions of economic models to extract a roadmap of the interests involved in the EPR process.

The relevance of the material to policymaking heightens in section three where Bohr discusses the need for regulatory intervention in WEEE management and the goals that have been declared in existing EPR strategy discussions. The primary driver behind the move toward assigning financial responsibility for environmental impact to the manufacturers of high technology hardware is the correlation between initial product design and the harm that product will exert when released in to the waste stream.¹⁰ The unique approach of holding a manufacturer responsible for the fate of its product after use by the consumer is fueled by the desire to encourage manufacturers to design products that do not adversely impact the

⁹ The Directive 2002/96/EC of the European Parliament and of the Council on Waste Electrical and Electronic Equipment (2003) is an example of a comprehensive WEEE management initiative with pedagogically helpful variances adopted by member states. The North American initiatives are more limited in nature and did not receive careful treatment in this thesis.

¹⁰ Bohr at 42

environment upon disposal.¹¹ Examples of product design elements policymakers would hope to encourage through the passage of EPR laws would be minimization of lead or mercury in electronic components,¹² ease of disassembly,¹³ and use of materials with an end-of-life resale value.¹⁴ Also of interest to stakeholders is Bohr's statement of the economic goals of EPR which reflect the overarching aim of the fair allocation of burdens between EEE manufacturers and other stakeholders.

Section four is a more specific treatment of the EU WEEE directive and the approaches member states have taken in response to the initiative. Bohr clearly conveys his dissatisfaction with the European approaches to EPR, claiming that none have provided an adequate incentive to reach their stated goals. His disdain for command and control regulation is demonstrated by his assertion that low mandatory collection goals, low monitoring ability, and no goals for the quality of WEEE processed creates strong disincentives to design products with consideration of end-of-life management and a strong incentive to illegally export WEEE to non-regulated countries. He argues that the misalignment of goals and implementation strategies actually discourages the life-cycle decision making process in EEE design.

The proposal for an alternative EPR process in section five will excite legal readers representing the EEE industries. Bohr's statement concluding his analysis of the WEEE directive programs that, "producers are neither interested nor proficient in waste management"¹⁵ perfectly illustrates the fundamental problem anticipated when undertaking this review. With this assertion in mind, he suggests assigning liability to EEE manufacturers for end-of-life waste

¹¹ *Id.*

¹² *See generally*, Frequent Questions: eCycling: US EPA, Frequent Questions, <http://www.epa.gov/epawaste/conserves/materials/ecycling/faq.htm#concern> (last visited on October 26, 2008) [hereinafter EPA FAQs] (EPA description of E-Waste hazardous materials)

¹³ Bohr at 50

¹⁴ EPA FAQs, *supra* note 12, <http://www.epa.gov/epawaste/conserves/materials/ecycling/faq.htm#enviro> (additional environmental impact statement)

¹⁵ Bohr at 76

management by means of a market based certificate trading program. Bohr anticipates that this will leave manufacturers out of the business of managing product waste by allowing them to buy certificates proportionally to the volume and type of materials they send in to the market. The primary source of regulatory influence would be the determination of a standard valuation mechanism that attaches cost to the difficulty in managing WEEE and the commissioning of a clearing house to trade EPR certificates. This clearing house would buy credits from a professional, competitive waste management syndicate that would use the proceeds to finance operations of waste management. By assigning monetary value to the difficulty of treating WEEE, Bohr concludes that producers would have an incentive to manufacture products with lesser environmental impact in the form of cheaper EPR certificates. This proposal also assumes that the increased value of waste management would create a more robust network of competitive waste managers who have a financial motivation to encourage consumers to properly dispose of their WEEE.

Although EPR has not been seriously considered in the United States, the fact that a number of states have attempted or succeeded in assigning producer responsibility for WEEE management dramatically increases the probability of more serious federal discussion on the matter.¹⁶ Unlike the management of consumer waste, which is fundamentally local in nature, management of WEEE guided by an EPR theory will create an environment where national and

¹⁶ See Cal. Health & Safety Code § 25214.9 (Deering 2007) (noting legislative findings that WEEE is a significant state issue and that product manufacturers should hold some responsibility in the management process); See also Me. Rev. Stat. Ann. tit. 38 § 16 (West 2008); 2007 Md. Laws 239; H.B. 793, 2007 Gen. Court, 185th Sess. (Mass. 2007); H.B. 3149, 2007 Reg., 85th Sess. (Minn 2007). The U.S. Legislature has only discussed legislation that would ban the illegal export of WEEE to developing countries. See e.g. S.Res 663, 110th Cong. (2008). A parallel phenomenon can be seen in the implementation of federal appliance efficiency standards in response to divergent state standards that exerted undue regulatory pressure on national product manufacturers. See US Gov't. Accountability Office, Energy Efficiency: Long Standing Problems with DOE's Program for Setting Efficiency Standards Continue to Result in Forgone Energy Savings 2(GAO-07-42)(2007)[hereinafter GAO]. The U.S. EPA has a voluntary product stewardship or "extended product responsibility" partnership program but their website claims that there is insufficient statutory authority to create a binding government program. See Basic Information: Product Stewardship: US EPA, Federal Government, <http://www.epa.gov/epawaste/partnerships/stewardship/basic.htm#feds> (last visited on November 3rd, 2008)

international manufacturers will have varying legal obligations in varying states. This risk management nightmare is a classic example of when federal intervention is traditionally sought.¹⁷ Although there is no reliable way to anticipate how the U.S. Legislature will respond to the increased burden on EEE companies, conscientious lawmakers should act to protect the environment while providing regulatory certainty to industry.

If stakeholders in this probable process can endure the explicit descriptions of modeling calculations and some language irregularities,¹⁸ they will appreciate the comprehensive qualitative analysis of Europe's EPR strengths and weaknesses. U.S. policymakers can leverage the lessons learned by Europe in to a more refined consideration of EPR goals, strategies, and tactics. These readers will also benefit from the detailed proposal that will assist policy discussions by targeting regulation to the stated goals of the policy, appease EEE manufacturers intimidated by entering the waste management market, and bolster waste managers by increasing the value of their services.

¹⁷ GAO *supra* note 16 at 2.

¹⁸ Bohr is a non-native English speaker. It is also possible that the language difficulties stem from the use of European English conventions. These factors make a reading of the thesis a bit strained for an American reader.