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**ADDRESSING ELECTRONIC WASTE IN
NEW YORK CITY**

An Extended Producer Responsibility Approach

Final Report prepared for the Natural Resources Defense Council

The following report is a synopsis of research findings produced by Columbia University Master of Public Administration in Environmental Science and Policy graduate students in the Workshop in Applied Earth Systems Policy Analysis. The following component research reports are also available: Report A contains case studies, while Report B provides a stakeholder analysis and Report C offers an analysis of recommendation options.

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In January 2006, the Natural Resources Defense Council (NRDC) sought consulting expertise from Columbia University to provide research regarding the Extended Producer Responsibility (EPR) approach to electronics recycling. EPR is currently being considered by the New York City Council as a way to address the growing electronic waste (e-waste) problem in the Big Apple. The Columbia University E-waste Workshop Team is comprised of twelve graduate students currently in the Masters of Public Administration Environmental Science and Policy program in the School of International and Public Affairs.

The primary goal of the Workshop Team has been to provide information and analyses that can contribute to the NRDC's effort identify effective solutions to New York City's growing e-waste problem. In order to achieve this goal, the Team created: 1) an analysis of current e-waste programs in the US and throughout the world, 2) a study of various stakeholder perspectives on EPR policy, and 3) recommendations based on an analysis of various implementation options. More generally, the work conducted by the Team should prove useful in evaluating policy mechanisms used by the currently proposed and other existing EPR laws. The views of relevant stakeholders may be used as a tool for understanding the local context of EPR policy as a solution for managing e-waste. The recommendations of the implementation analysis will be beneficial to the NRDC by providing an overview of key challenges and opportunities associated with EPR strategies.

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List of Acronyms

Apple	Apple Computer, Inc.
ARF	Advanced Recovery Fee
CRT	Cathode Ray Tube
DEP	Department of Environmental Protection
DSNY	New York City Department of Sanitation
EPA	United States Environmental Protection Agency
EPR	Extended Producer Responsibility
HP	Hewlett-Packard Development Company, L.P.
Int. 104	Introduction 104, the Electronic Equipment Recycling and Reuse Act
MCRR	Manufacturers Coalition on Responsible Recycling
NRDC	Natural Resources Defense Council
OECD	Organization for Economic Co-operation and Development
WE ACT	West Harlem Environmental Action, Inc.
WEEE	Waste Electrical and Electronics Equipment

Executive Summary

I. Electronic Waste

Electronic waste or e-waste, as it is commonly known, is “any appliance using an electrical supply that has reached its end-of-life.”¹ This classification includes household appliances, personal computers, televisions, cell phones, and numerous other consumer products.² When introduced into landfills and incinerators in the traditional waste stream, e-waste exposes humans and the environment to the hazardous materials contained within the electronic products. Since e-waste has become one of the most rapidly growing components of the waste stream,³ its management is an important environmental and public health concern.

Currently, no federal legislation addresses the e-waste problem. Notably, the Resource Conservation and Recovery Act provides exemptions for household hazardous waste and e-waste from households and small businesses.⁴ Several state and local governments have developed policies to counter the lack of national regulation. One policy mechanism is extended producer responsibility.

II. Extended Producer Responsibility Policy

The principle of extended producer responsibility (EPR) aims to make producers or manufacturers of electronic products responsible for the transportation, recycling, and disposal of their own products. As a result, the policy generates accountability for manufacturers of electronic products and encourages firms to internalize recycling and disposal costs. This policy gives producers the incentive to improve product design by decreasing the use of toxic materials and increasing the ease of recycling.

Introduction 104, also known as the Electronic Equipment Recycling and Reuse Act, attempts to legislate extended producer responsibility policy within New York City. If enacted, this legislation would shift responsibility for the collection and recycling of electronic products from the government onto manufacturers. In addition, each manufacturer would have to contribute to the costs of recycling products whose manufacturers cannot be identified or are no longer in operation. The products covered under the existing bill are computers, monitors, televisions, portable digital music players, and any device with a display screen wider than four inches.

The proposed Electronic Equipment Recycling and Reuse Act also establishes collection benchmarks, beginning with 30% of sales by the year 2010 and increasing to 80% by the year 2018. If manufacturers choose to donate functioning electronic equipment to non-profit organizations, they will receive credit toward the minimum collection goals. The bill prohibits the sale of products from any non-compliant manufacturers and requires the New York City Department of Sanitation to report to the City Council regarding the implementation of the EPR program and the rates of recycling that have been achieved.⁵

III. Findings from the Columbia Workshop Study of E-Waste Programs and Stakeholder Views

In the United States, Maine and Washington will operate statewide EPR programs. The European Union operates programs under the European Waste from Electrical and Electronic Equipment Directive (WEEE). While each legislative measure aims to manage electronic waste, many policy choices exist regarding which products to include and how to divide up physical and financial responsibility. Appendix 1 summarizes details about some of the EPR initiatives discussed in the report.

Stakeholders such as manufacturers, the New York City Department of Sanitation (DSNY), consumer interest groups and environmental organizations disagree as to whether extended producer responsibility is the best policy mechanism for municipal e-waste management. While some manufacturers support EPR policy, others would prefer to share costs with consumers through an advanced recovery fee. Consumers pay an advanced recovery fee at the time of new product purchase, placing responsibility on the retailers for collection. The logic behind the fee is that consumers are already accustomed to paying a user fee to ensure the proper recycling or disposal of used motor oil, tires and car batteries; therefore, an advanced recovery fee for electronic products would be analogous.⁶ DSNY is in favor of e-waste management although it would rather that EPR legislation be developed and implemented at the state level.⁷

Consumer interest groups approve of EPR policy, in part, because consumers bear no direct or visible financial burden of managing e-waste. Even so, such organizations stress the importance of educating consumers about e-waste programs and providing convenient e-waste disposal options. Environmental organizations advocate EPR policy due to the reduction of environmental and health hazards with proper e-waste disposal. However, such groups call for mechanisms to avoid other environmental concerns such as the health hazards resulting from the exportation of electronic equipment to other countries.

Most of the stakeholders would prefer to have a federal law or national policy. Individualized programs at the state or municipal levels provide economic and logistical difficulties for manufacturers and the regulating authorities.

IV. Recommendations

With regard to the financial responsibility of an EPR program, the research group recommends that the program allows manufacturers to choose between individual and collective financial responsibility for the EPR program. Known as equivalent share, this method provides flexibility to manufacturers, as each producer may choose the most cost-efficient way to comply with EPR policy. Each manufacturer can decide to individually take back their own brand products or to form a collective program with other manufacturers. Support for equivalent share can be gained from manufacturers that already operate e-waste recycling programs, who would oppose mandatory collective responsibility, as well as from manufacturers who would prefer collective responsibility over financing the take-back of their own products. Although equivalent share may not have the strongest incentive for manufacturers to design more environmentally-friendly products, it remains the lowest cost option for manufacturers to take responsibility for e-waste management. Equivalent share minimizes compliance costs by giving manufacturers flexibility.

The research group recommends curbside collection as the best practice for picking up and transporting e-waste from private households in New York City. Curbside collection is the most palatable option for the citizens of New York City. Numerous studies have found correlations between consumer convenience and high collection rates of recyclable materials.^{8,9} Particularly, consumer willingness to recycle e-waste is heavily influenced by convenience.¹⁰ This collection method is particularly recommended because New Yorkers tend to rely on public transportation in New York City, making drop-off sites less feasible than in places dominated by automobile transport. Curbside collection is an effective method to achieve e-waste collection targets; nevertheless, in our view, New York City's EPR legislation should not *mandate* curbside collection requirements. Manufacturers should decide how to collect electronic products, while being cognizant of the advantages of curbside pickup in a densely populated urban area.

V. Next Steps

The extensive analysis of extended producer responsibility in New York City also revealed a number of issues that require further research. Appendix 3 examines several of these topics. Particularly, a future study should analyze the costs associated with implementing an EPR program in a city with the size and population of New York City. These expenditures would include the physical management of the program, its administration, and proper communication with consumers and other parties regarding their roles and responsibilities.

ADDRESSING ELECTRONIC WASTE IN NEW YORK CITY AN EPR APPROACH

What is electronic waste and why is it a problem?

Electrical and electronic waste is defined by the Organization for Economic Co-operation and Development as “any appliance using an electrical supply that has reached its end-of-life.”¹¹ E-waste, as it is also called, includes household appliances, personal computers, televisions, cell phones, and numerous other consumer products.¹² Improved technological advances and high demand have allowed these products to be rapidly produced at lower prices, enabling increased consumption of electronic products nationally. For example, although personal computers only make up a fraction of all e-waste, they are especially subject to rapid obsolescence due to technological improvements that cause companies to market new and improved models every few months. At the global level, 100 million personal computers were disposed of in 2004 and this quantity is expected to increase.¹³ In New York City, 0.7% of the waste stream or 480 tons of electronic waste per week are discarded at a disposal cost to the City of approximately \$2.72 million per year.¹⁴

As a result of increased production and decreased life spans, electronic waste is one of the fastest growing components of the waste stream.¹⁵ The toxic components in e-waste makes the landfill and incinerator disposal of these products particularly problematic. E-waste contains metals such as cadmium, lead, mercury, and brominated flame retardants that can pollute groundwater if disposed in a leaking landfill. The incineration of e-waste releases some of these heavy metals into the atmosphere while the remainder of these metals is sent to landfills as a component of incinerator ash. In landfills, these metals can produce contaminated leachate. Leachate is a liquid that forms in landfills from waste that can percolate through the soil carrying substances from the waste and has the potential to contaminate soil and waterbodies. The majority of electronic devices tested create leachate that exceeds the Resource Conservation and Recovery Act limit of five milligrams per liter of lead. Leachate with lead concentrations above the threshold is considered hazardous waste.¹⁶ However, since the Resource Conservation and Recovery Act includes an exemption for household hazardous waste, e-waste from households and small businesses remains unregulated at the federal level.¹⁷ The lack of national legislation has encouraged the development of state and local policies to address the e-waste problem. Though there are many approaches to dealing with e-waste, one concept has been extended producer responsibility (EPR). This model provides incentives for redesigning products that minimize environmental impacts, including by using environmentally-safer materials and by designing products that can be more efficiently recycled or reused.

What is extended producer responsibility and how can it help manage e-waste?

The Organization for Economic Co-operation and Development defines the principle of extended producer responsibility as follows: “producers of products should bear a significant degree of responsibility (physical and/or financial) not only for the environmental impacts of their products downstream from the treatment (recovery) and/or disposal of the product, but also for their

upstream activities inherent in the selection of materials and in the design of products. The objective of EPR is to reduce the volume and hazard from products at the post-consumer stage.”¹⁸ Therefore, producers or manufacturers of electronic products are primarily responsible for transporting, recycling and disposing their own products under the EPR model.

EPR requires that the people who use the most electronic equipment pay for their share of recycling in the form of higher prices, assuming that producers and manufacturers add the cost of transporting, recycling and disposing of their products into the cost of the product at sale. This cost structure is known as an invisible or hidden fee and differs from government-run recycling programs which are financed by all taxpayers.¹⁹

Currently, 89% of the volume of municipal solid waste in the United States consists of product waste-packaging and unwanted products including e-waste.²⁰ EPR policy would encourage environmental accountability for producers by encouraging firms to design products which are less toxic and more recyclable. Although some U.S. states have begun to implement EPR policy, established EPR programs in Sweden have been shown to promote design changes that improve environmental performance, as well as the development of essential recycling infrastructure. According to manufacturer interviews conducted by Tojo, impending EPR legislation was the single most mentioned factor promoting environmentally friendly product design changes.²¹

Even so, the implementation of an EPR program can be challenging. Although there are relatively few existing EPR programs, these programs vary by: the way that responsibility is assigned, the implementation of the EPR system, and the measures used to ensure compliance.

What e-waste policy is proposed for New York City?

Introduction 104 (Int. 104), the Electronic Equipment Recycling and Reuse Act, was introduced on February 15th, 2006 and referred to the Committee on Sanitation and Solid Waste Management.²² Prominent among the 13 sponsors of Int. 104 is the Chair of the Committee on Sanitation and Solid Waste Management Michael McMahan. Mr. McMahan represents the North Shore of Staten Island and is well known for his support of city recycling programs and the closure of Fresh Kills landfill.²³ Previously, the Electronic Equipment Recycling and Reuse Act had been submitted as Int. 643 in 2005.

The products covered by Int. 104 include computers, monitors, televisions, portable digital music players, and any device with a display screen wider than four inches. Manufacturers are responsible for collecting and recycling their own brand of products and, additionally, are assigned a share of the responsibility for products whose manufacturers have gone out of business or cannot be identified. Manufacturers are required to submit an Electronic Waste Management Plan to DSNY for approval, detailing their plan for compliance. Manufacturers have considerable flexibility in how they choose to comply with the regulation. Instead of individually taking back their own products, manufacturers have the option of working together to manage their e-waste collectively. Regardless of how producers comply, they are prohibited from funding their program with a visible fee charged to consumers.²⁴ Manufacturers must also meet performance goals for the amount of e-waste that must be collected.

Int. 104 sets minimum collection targets, starting with 30% of sales in 2010, and gradually increases to 80% by 2018. Manufacturers can receive credit toward meeting the minimum collection goals by donating working electronic equipment to non-profit organizations. The principle enforcement mechanism is a sales ban, as manufacturers not in compliance are prohibited from selling their products in New York City. DSNY is required to report on the implementation of the program and the resulting recycling rates to the City Council.²⁵

How have EPR policies been used to address the electronic waste problem outside of New York City?

Over the last decade, regulation has increased both here and abroad. Although all the legislation shares the goal of environmentally-sound e-waste disposal, methods for pursuing this goal have varied. We selected a number of current and proposed e-waste initiatives as case studies for further analysis. Appendix 2 provides a sampling of such initiatives. In some cases, legislation accompanies recycling programs already offered by producers in the electronics industry.

United States Case Studies

Maine

Maine's e-waste program was enacted in April 2004. The leading supporters of the bill were Portland Mayor Jim Cohen and Maine Department of Environmental Protection Commissioner David Littell. In addition, the Natural Resources Council of Maine and the Learning Disabilities Association of Maine also supported the legislation. After the Maine bill was introduced, industry leaders were split on whether or not to endorse the measure. One reason for this division was the difficulty that the industry might face in dealing with different rules in different states and the hope that federal legislation could establish a uniform recycling measure. According to the Bangor Daily News, at the time of the bill's hearing, "at least four major computer manufacturers – Dell, Apple, Gateway and Hewlett-Packard – support an e-waste recycling plan that splits the responsibility among consumers, manufacturers and the state."²⁶

As it was originally introduced, Maine's legislation proposed that consumers pay a \$6 recycling fee when purchasing a television or computer monitor while the remainder of the recycling costs would be placed on the manufacturer directly. The fee would offset the overall costs to manufacturers and serve as an approximate measure of "shared responsibility" for which the bill came to be known. Despite the fee's goal of attracting industry support, major manufacturers such as Panasonic, Phillips, Magnavox, IBM and Sharp still opposed the bill, preferring that consumers pay for the recycling and disposal of electronic waste.²⁷ The fee was eventually dropped from the bill, but the notion of "shared responsibility" remained a central element to the bill's design.

Program Design

On January 18, 2006, Maine's e-waste program came into operation. The final rules promulgated by the Maine Department of Environmental Protection (DEP) split the full cost of recycling electronic waste between consumers, municipalities and manufacturers.

A formal ban on disposal of e-waste at municipal landfills creates the incentive for consumers to initiate the recycling process by taking a television or computer monitor to a municipal receiving station. The receiving station can be anything from a station in a parking lot during a designated day and time to a municipal waste center operated on a daily basis. Here, the consumer is assessed a \$2 fee per unit recycled as shown in Table 1 below. After receiving the TV or monitor, the municipality is responsible for sending the unit to a consolidation center.²⁸

Table 1: Maine's Shared Responsibility Program

<i>Consumer</i>	<i>Pays cost of:</i> 1) \$2 fee per unit, payable at time of disposal
<i>Municipality</i>	<i>Pays cost of:</i> 1) Operating a receiving center 2) Sending units to consolidation center 3) Public education campaign
<i>Manufacturer</i>	<i>Pays cost of:</i> 1) Operating consolidation center 2) Transporting waste to recycling center 3) Recycling units at a certified facility

Under Maine's rules, the private consolidator is to identify the manufacturer for each unit it receives and provide this information to the Maine DEP. Each year, the DEP publishes a list of manufacturers and the amount of waste received. The manufacturer is then responsible for the paying the consolidator the full costs associated with the handling, transporting and recycling their individual television and computer monitor products, along with a portion of the costs associated with the orphan products whose manufacturers can not be identified or who are no longer in business.²⁹ Although manufacturers have a choice of options for compliance, the manufacturer remains directly responsible for the costs of recycling its own units, as well as its share of the orphan waste costs.

As of March 20th, 2006, 89 manufacturers had registered with the Maine DEP. These producers represent an estimated 92% of the projected television waste and 82% of the computer monitor waste collected during the first full year of implementation.³⁰

Finally, in an effort to avoid potential environmental externalities due to the improper handling or shipping of recyclable electronic waste to foreign countries, the law requires that the consolidator ship the electronic waste to recycling facilities certified by the Maine DEP for having environmentally-sound business management. Currently, the Maine DEP has published a list of 35 such recycling facilities in the greater New England area.³¹

Washington

On March 29, 2004, the former Governor of Washington, Gary Locke, signed HB 2488, which directed the Washington State Department of Ecology to work with the state Solid Waste Advisory Committee to conduct research and develop a recommendation for implementing and financing an electronic product collection, recycling and reuse program.³² In December 2005, a

final report was delivered entitled “Implementing and Financing an Electronic Product Collection, Recycling and Reuse Program.” As a result of the report, two bills, HB 2662 and SB 6428, were introduced on January 11 and 12, 2006. The identical bills follow an EPR approach providing electronic product recycling opportunities in Washington through programs financed and implemented by electronic product manufacturers.

In March 2006, Senate Bill 6428 was passed in both the state House and the state Senate. The goal of this legislation is to ensure that manufacturers are responsible for financing an environmentally-sound system for dealing with obsolete electronic products in an EPR approach. The bill’s provisions apply solely to computers and televisions. The bill had strong support from Hewlett-Packard, Amazon.com, Wal-Mart, the Washington Retail Association, local governments, environmental groups and the state Department of Ecology.³³

Program Design

The bill mandates that manufacturers of computers and televisions sold within Washington must register and participate in the mandatory standard plan or a comparable independent plan to implement and finance the collection, transportation and recycling of its equivalent share of electronic products in the market by January 1, 2009. A manufacturer can apply to participate in the independent plan if they represent at least 5% return share of covered electronic products in the state and have been established as a producer in the state for at least 10 years. If manufacturers recycle less in one year than their equivalent share, they must pay a fee to reconcile the difference.³⁴

The Washington Materials Management and Financing Authority is tasked with running the standard program, which provides transportation, collection and processing of e-waste for all manufacturers not approved to independently manage their own waste. The Authority will be managed by a board of directors consisting of elected manufacturer representatives. Five of the Board of Directors positions are reserved for the top 10 manufacturers of covered products by return share, six are available for other manufacturers. Certain state government officials, such as the Director of the Department of Ecology, are also guaranteed a position on the board of directors. The Washington Materials Management and Financing Authority charges fees to participating manufacturers to cover all administrative and operational costs of the standard plan. If a manufacturer does not agree to participate in the standard plan, they will be fined up to \$10,000. If the manufacturer refuses to participate within 90 days, they will be prohibited from selling electronics in the state.³⁵

In addition, manufacturers are responsible for educating the public on how to recycle their products. The manufacturer must also supply at least one collection site for any city or town with a population greater than 10,000 citizens.

Manufacturers must report the following data after the second program year and every year thereafter: the total weight in pounds of electronic products collected and recycled by each county in the preceding year, a list of collection services in each county, a list of processors used and a description of educational and promotional efforts undertaken. An additional requirement is that processors must document the chain of custody for the electronic products that they obtain.

To measure the program's effectiveness, by December 31, 2012, the Department of Ecology must report to the legislature the weight of electronic products recycled and compare the results with programs in other states, as well as report the performance of each manufacturer's plan in meeting its equivalent share. Finally, the Department of Ecology must report descriptions of the various programs used by manufacturers and document the community responses to the program in general.

International Case Studies

European Waste from Electrical and Electronic Equipment Directive

The European Union began to formally address the issue of large and increasing quantities of hazardous e-waste being dumped into landfill sites toward the end of the 1990s. At the time, the rate of hazardous material entering landfills was growing three to five times faster than the rates of traditional municipal waste.³⁶ In response to these concerns, the Waste Electrical and Electronics Equipment (WEEE) Directive was created by the European Parliament to mitigate the level of hazardous waste introduction into landfills from electronic products through a separate collection system. The WEEE Directive also aims to reduce the amount of hazardous materials used in electronic equipment sold in the European Union.

The Directive was supported by the European Committee of Domestic Equipment Manufacturers, who acknowledged potentially higher prices for consumers, but also agreed that the Directive should take strong action to deal with environmental contamination from electronic waste. Also supporting the Directive was the European Environmental Bureau, which suggested that producers should be mindful of the long-term implications of the products they choose to manufacture.

However, a number of groups were opposed to the WEEE Directive. The Confederation of British Industry was concerned that the implementation dates were hastily crafted and did not allow sufficient time for manufacturers to prepare. The European Electrical Industry was critical of the Directive, as was the United States electronics industry, arguing the WEEE Directive led to unfair rules that hampered trade agreements signed under the World Trade Organization.³⁷

Program Design

The WEEE Directive, passed in August 2004, was designed to reduce the total amount of electronic waste contaminating the municipal waste stream. Electronic products introduced to the market before August 13, 2005 were deemed "historical" and are subject to collective financial and physical responsibility, while products introduced after that date are subject to individual manufacturer financial responsibility.³⁸ The latter collection method allows individual companies to innovate and design their own methodologies for the assembly and deconstruction of their products. However, individual producer responsibility requires each company to establish "its own take-back program for its own products."³⁹

Products introduced into the market after the key date of August 13, 2005 must have an associated financial guarantee supported by the producer. In addition, producers are financially

responsible for costs “when supplying new equivalent products” to replace those introduced on the market before August 13, 2005.⁴⁰

The WEEE Directive explicitly lists 10 different categories of electronic equipment that are covered, including:⁴¹

1. Large household appliances,
2. Small household appliances,
3. Information technology and telecommunications equipment,
4. Consumer equipment,
5. Lighting equipment,
6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools),
7. Toys, leisure and sports equipment,
8. Medical devices (with the exception of all implanted and infected products),
9. Monitoring and control instruments, and
10. Automatic dispensers.

In addition to the 10 categories, the WEEE Directive also lists exemptions for certain types of products such as military equipment.⁴²

One of the main features of the WEEE Directive is that it assigns environmentally-responsible production to the manufacturers of the product. Manufacturers are responsible for the waste contained in their products and, while financially responsible for the collection and disposal of these electronic products as an individual manufacturer, they can choose to manage the electronic waste individually or as part of a collective. The Directive also mandates specific rates of collection that must be achieved. The collection target of four kilograms or 8.8 pounds per person each year must be achieved by the end of 2006.⁴³ However, these recycling and recovery rates will be reviewed and may be revised in December 2008, “after which they may be based on the amount of specific products on the market rather than the amount of electrical and electronic waste separately collected.”⁴⁴

The Directive enables producers to recover costs associated with “historical” products. Producers have the ability to recover some costs of the Directive’s implementation by applying a visible fee on new products for eight years or on large products for 10 years.⁴⁵ The WEEE Directive also requires producers to more clearly label their products to avoid their disposal with non-electronic waste products in municipal solid waste. Manufacturers are prohibited from using equipment that prevents the recycling of a product. For example, ink-jet cartridges that cannot be re-filled or re-used are not acceptable under the Directive.⁴⁶ Lastly, hazardous substances are prohibited from being used in products. This specific stipulation of the WEEE Directive became known as the Restriction of the use of certain Hazardous Substances Directive in electrical and electronic equipment.

Some manufacturers support the Directive and are enticed by the competitive opportunity to individually develop their firm and to advance creative, environmentally-friendly product design. With the Directive in place, “producers will be responsible for taking back and recycling

electrical and electronic equipment. This will provide incentives to design electrical and electronic equipment in an environmentally more efficient way, which takes waste management aspects fully into account. Consumers will be able to return their equipment free of charge.”⁴⁷ Products that are designed to incorporate recyclable components will reduce the amount of electronic and electrical waste continually entering municipal landfills and incinerators.

Sweden

Sweden has been credited as the first country in the world to recommend extended producer responsibility as an environmental policy goal, which it proposed in 1990.⁴⁸ Sweden’s first EPR program was for automobiles in 1997, replacing a deposit-refund system for cars that had been in place since 1975. EPR for electronic products became mandatory in 2001 with the enforcement of the “Ordinance on Producer Responsibility for Electrical and Electronic Products.”⁴⁹ Most recently, Sweden has revised its EPR laws to comply with the WEEE Directive, which mainly required the addition of registration, reporting and labeling requirements.⁵⁰ Producers must clearly mark their products with a crossed out rubbish bin symbol and must list identifying information about the manufacturer and the date that the device was put on the market.⁵¹ The changes became enforceable on August 15, 2005 and the new reporting requirements began in April 2006.⁵² WEEE Directive compliance is not expected to significantly change the basic structure of Sweden’s e-waste management, which is handled collectively by a single producer responsibility organization called El-Kretsen.⁵³

Program Design

Although manufacturers have full financial responsibility for recycling, individual municipalities are required to establish collection centers where consumers can drop off products. Currently, there are about 600 collection centers for household e-waste run by local municipalities.

Manufacturers have the option to individually comply with the Swedish EPR law, but about 95% of producers have chosen to comply by joining the producer responsibility organization El-Kretsen. El-Kretsen pays for the cost of recycling by charging members a flat annual fee to join and a variable fee based on the number and type of products sold in the previous year. This method of cost allocation is also known as a market share approach.⁵⁴ While El-Kretsen itself has monopolistic power in the management of producer responsibility and e-waste collection, it does not carry out the recycling. Recycling is contracted out by competitive bidding to regional recyclers.⁵⁵ In 2005, El-Kretsen had 607 member firms and arranged for the recycling of 87,000 tons of e-waste which amounts to almost 22 pounds per capita.⁵⁶

What do major stakeholders in New York City think about EPR?

The implementation of electronic waste regulations impacts the general public, commercial and nonprofit interests, and industries. Thus, the research group sought to investigate stakeholders’ opinions as to the best methods and practices to accomplish the goal of disposing electronic waste in an environmentally-friendly manner. Most stakeholders acknowledge the importance of creating an effective system to deal with electronic waste and are willing to participate in the process. The research methods employed in the following analysis consisted of personal interviews, complemented by a content analysis of published stakeholder testimonies and reports.

Manufacturers

Since their products are being regulated, manufacturers will bear the majority, if not all, of the costs associated with program management and compliance under EPR policy. Therefore, their input is essential to ensure that the policy being developed is not only economically feasible but also provides a level playing field conducive to efficient market competition. Many manufacturers have stated that they prefer a national electronic waste policy rather than a state-by-state approach because a single standard allows them to reduce compliance and management costs. Nevertheless, numerous manufacturers continue to work closely with state governments in the development of electronic waste policies.

Manufacturers in the United States generally fall into two categories when considering electronic waste policy: those who prefer extended producer responsibility (EPR) as a policy option and those who prefer advanced recovery fees (ARFs). On one end of the spectrum are manufacturers such as Dell and Hewlett-Packard, who support an EPR policy approach,⁵⁷ and on the other end of the spectrum are the Manufacturers Coalition for Responsible Recycling and Apple Computer, Inc. (Apple), who support an ARF policy approach as a mechanism for ensuring that the financial responsibility of recycling electronic waste is more evenly distributed.

Hewlett-Packard (HP)

HP believes that, in order for a manufacturer to qualify for an individual take-back e-waste program and avoid paying a fee to a collective e-waste system, a manufacturer should only be required to recycle its return share of the covered electronic device waste stream.⁵⁸ HP argues that “basing manufacturer payments and the alternative recycling obligations on return share will result in a system that is internally consistent, linked to actual recycling behavior and needs in the state, and more easily implemented [than a market share approach].”⁵⁹ One reason for HP’s stance is concern over industry-wide equality, meaning that HP believes that new manufacturers should not have to pay for the recycling of other manufacturer’s products, as this distribution would place an unfair burden to newer manufacturers.⁶⁰

Manufacturers Coalition for Responsible Recycling and Apple Computer, Inc.

The Manufacturers Coalition for Responsible Recycling (MCRR) prefers an advanced recovery fee approach to ensure that the cost of the program is directly tied to individual sales.⁶¹ Its members include Canon USA, Epson, Hitachi America, IBM Corporation, JVC America, LG Electronics, Mitsubishi Digital Electronics America, Panasonic, Philips, Pioneer, Samsung Electronics America, Sanyo Fisher, Sharp Electronics, Sony Electronics, Thompson, Inc., and Toshiba.⁶² However, if a market-share system is used, MCRR recommends that the legislation incorporates a “first seller” approach, which dictates that the first seller into a regulated state or city should impose a fee on the purchaser in the price of the product.⁶³

Apple also favors a market-share approach, which includes business-to-business contracts in calculating U.S. national market share. Because these computers will eventually enter the waste

stream, it is important that business-to-business contracts be included in the U.S. market share calculation so that adequate funding is obtained.⁶⁴

Apple also argues that all manufacturers, regardless of whether they have their own take-back program, should pay into the system on the same fee schedule.⁶⁵ Those manufacturers that provide their own take-back system and who can prove they meet similar performance standards would be entitled to reclaim a percentage of that fee.⁶⁶ Requiring all manufacturers to initially pay into the system will ensure that there is sufficient funding for the management of historic and orphan waste.

New York City Department of Sanitation

The Department of Sanitation (DSNY) in New York City currently collects over 12,000 tons of residential waste and recyclables each day.⁶⁷ DSNY is an integral stakeholder when discussing the disposal of e-waste. During 2005, regular collection of curbside municipal waste occurred two to three times per week throughout the City in order to manage the more than 50,000 tons of waste produced each week.⁶⁸

Recycling Events

DSNY has a history of facilitating the recycling of e-waste in the City. Throughout all five boroughs at the end of 2004, DSNY sponsored electronic recycling events. In the course of eight total events, New Yorkers returned approximately 50 tons of obsolete computer equipment.⁶⁹ Based upon the initial success in 2004, the recycling events were continued in 2005. DSNY, considers the program to be a success, as it increased consumers' awareness of the need to properly dispose of household electronic waste.

Implementation

While an EPR program in the City would impose the financial responsibility on manufacturers, DSNY would likely be required to administer the program. DSNY believes that whatever plan manufacturers develop, consumers will bring their e-waste to a central location or manufacturing center.⁷⁰ Manufacturers would be required to submit their implementation plan to DSNY for administrative review and it is possible that joint programs may be developed. These joint programs occur when multiple manufacturers develop a single plan for approval and implementation. DSNY staff we interviewed specifically commented that they would prefer EPR legislation be developed and administered at the state level.⁷¹ The reasoning is that the purchasing power harnessed by states would have a greater effect than the funds available on a municipal level. Therefore, a state would be in a better position to drive the successful implementation of an EPR program.

Consumer Interest Groups

Even though EPR policy transfers the responsibility for dealing with e-waste from the consumer to the producer, any successful policy will inevitably require the cooperation of consumers. Convenience is one of the most critical issues to address in designing an e-waste regulatory

program because of the role the consumer plays in deciding what to do with an electronic product that has reached the end of its useful life. Regardless of whether an environmentally-friendly method of disposing electronic waste is available, if the consumer feels inconvenienced by the procedure established, electronic waste may still be disposed improperly or illegally. Therefore, the role and responsibility of the consumer must be clearly defined and communicated. Consumer groups in New York City support manufacturer financial responsibility, disposal convenience, and reduced environmental impacts of recycling as three objectives of e-waste policy.

Manufacturer Financial Responsibility

Both the Consumers Union and the Office of the Public Advocate for the City of New York (the Public Advocate) support legislation that requires the manufacturer to bear the financial responsibility of collecting, handling, and recycling or reusing e-waste without the imposition of a visible fee on consumers. According to the Public Advocate, “consumers will likely be bothered by the introduction of a new tax on electronics.”⁷² The internalization of the costs of recycling and disposal for the manufacturer creates a financial incentive that could potentially reduce the amount of hazardous material of certain products and the end cost to consumers. The Consumers Union embraces this outcome of EPR policy, stating that it “prevents the externalities or undesirable consequences of product production from being shifted onto the consumer and local governments.”⁷³

Disposal Convenience

In nearly all case studies of existing EPR programs, consumers were expected to physically bring their e-waste to a collection facility. A similar disposal mechanism would be problematic in New York City because many residents rely on public transit. Given this reliance on public modes of transportation, “it seems unreasonable to expect individuals to bring electronic equipment, which is often large and cumbersome, by bus and/or subway to designated drop-off sites.”⁷⁴ Consumer groups recognize that transportation is a hurdle to implementing an e-waste program in the City and recommend various options to make disposal as convenient as possible for the consumer. The Consumers Union recommends that recycling locations be near communities and have variable hours of operation to accommodate the widely varied schedules of city residents.⁷⁵ The Public Advocate believes that a more realistic option for New Yorkers is to use curbside pick-up as the dominant collection method. While convenience is an important factor to consider regarding consumers’ willingness to participate in an EPR program, another consideration is that consumers have faith that once their e-waste is disposed of, it is handled and recycled in an environmentally-responsible way.

Reduced Environmental Impacts of Recycling

Recent newspaper reports have publicized that some electronic waste meant to be recycled in the U.S. in an environmentally-sound way had been transported to foreign countries where little or no environmental, health and safety regulations exist.^{76,77} This exportation has exposed foreign workers and their surrounding environment to hazardous materials from the electronic products. Both the Public Advocate and the Consumers Union believe that consumers in the United States

are concerned with issues regarding the environmental effects of electronics recycling and these organizations have provided additional recommendations for regulating recyclers. The Consumers Union recommends that sound environmental management certification of recyclers should be overseen by a third-party.⁷⁸ Currently, the certification process in Maine is managed through the State Department of Environmental Protection. The Public Advocate does not disapprove of a state-level certification process, but believes that recycler certification should be standardized at the national level.

Environmental Organizations

Due to the potential environmental impacts of e-waste in landfills and incinerators and concerns over socially irresponsible exports, environmental groups are the main advocates of e-waste policy.

Implementation

A market-driven collection program that incorporates competition is the preferred option among environmental organizations. A state-run bureaucracy is the least preferable option to these groups because in their view it creates inefficiencies in the recycling market. According to Clean Water Action, a state program would necessitate fees that are “guaranteed to be either too high or too low in order to run the program.”⁷⁹ As an alternative implementation mechanism to using a government agency or other single entity, multiple third party organizations could establish agreements with recyclers to transport and recycle collected electronic waste through a competitive bidding process.

Worker Safety

Both the New York City Group of the national Sierra Club and a local environmental justice group, West Harlem Environmental Action, Inc. (WE ACT), recognize the importance of designing an e-waste program that also protects the workers who may handle e-waste. According to WE ACT, “the exposure of city sanitation employees to hazardous materials originating from electronic waste is a significant issue of environmental justice.”⁸⁰ According to the Sierra Club, it would be ideal for a New York City e-waste program to follow the same recycling and reduction standards created by the European Union’s Waste Electrical and Electronics Equipment Directive.⁸¹ Furthermore, compliance with the European Reduction of Hazardous Substances Directive banning the use of certain hazardous materials is supported by both Clean Water Action⁸² and INFORM, Inc.⁸³

Recyclers

Recyclers expressed opposition to a city level electronic waste program. According to Peter Muscanelli, the Director of the International Association of Electronic Recyclers, the recyclers who are members would prefer a single standard that encompasses all states and municipalities on the federal level. If other municipalities followed New York’s lead and created their own electronic waste programs, “it would be a real challenge to the recycling industry.”⁸⁴ One could easily imagine a scenario where, if other municipalities adopt stand-alone recycling measures, a

recycler in Connecticut would have to comply with multiple program standards for Maine, Boston, New York City and any other states shipping their waste to facilities. Out of concern for their membership, the recycling organizations spoken to for this analysis preferred to remain neutral on the many models being proposed, but it remains eminently clear that with multiple regulations being separated by only short geographical distances, significant difficulties may arise in the daily and long-term logistical operations of many recyclers.

The Institute of Scrap Recycling Industries, Inc. is an organization that represents 1,200 members dealing in the processing, brokerage and industrial consumption of electronic waste internationally. This group supports an EPR approach to electronic waste management, since “traditional scrap commodity markets are governed by supply and demand whereby artificial interference in the marketplace can cause significant disruptions to the long term economic viability of markets.”⁸⁵ The short-term effect of New York City instituting an electronic waste collection program may be to increase the demand for service among the 50 electronic recyclers in New York State, which would create a growth incentive for the industry. However, the long-term market uncertainties that would arise from multiple regulations may lead to the creation of inefficiencies within the marketplace, which in turn may discourage growth. It is, therefore, unclear as to what the final effect a New York electronic waste program would have on the regional recycling industry.

Retailers

The retail industry is an important stakeholder to consider because, depending on the type of program implemented, there may be a significant impact upon the industry. Retailers tend to oppose ARF programs and favor EPR policies. In California, retailers have had to reconfigure their computing systems to register the ARF fee paid by consumers at the time of purchase. Programming computers solely in California retail outlets, rather than nation-wide, has proven to be a burdensome and costly process. Although three percent of the ARF fee is passed on to retailers to alleviate this cost, many argue it is not sufficient to cover the added expense.⁸⁶ This position is also advocated by the Consumer Electronics Retailers’ Coalition, an advocacy group representing electronics retailers. They have compiled a detailed legislative advocacy platform, which stresses the need for regulations to be implemented at the federal level and strongly opposing any point-of-sale (i.e. ARF) methods of electronic waste regulation.⁸⁷

How could an EPR program be implemented in New York City?

There are two distinct areas of responsibility to consider in EPR policy, which are the financial responsibility for program costs and the physical responsibility for collection, sorting and recycling.⁸⁸ The available options for the design and implementation of EPR policy in New York City are as follows:

1. Financial responsibility addresses who will pay for the EPR program, how much the party is responsible for paying, and the implications of the financial responsibility mechanism chosen.

2. Physical implementation discusses the feasibility of collection options for getting electronic waste from individual residences into a recycling system within the specific context of New York City.

Options for Financial Responsibility

A key aspect of an EPR system is determining how much funding each manufacturer should contribute. Since the concept of EPR does not specify the financial instruments that are most appropriate, each EPR program takes a different approach to the allocation of responsibility.⁸⁹ This section defines and analyzes three broad financial responsibility options:

1. Collective financial responsibility through market share
2. Individual financial responsibility through return share
3. Equivalent share

Collective Financial Responsibility Through Market Share

Collective financial responsibility means that manufacturers within the same product group, regardless of brand, would be held jointly responsible for the total cost of the collection, sorting and recycling of their products.⁹⁰ Collective financial responsibility distributes costs among manufacturers based on market share. Market share can be measured by sales revenue, number of products sold, or by weight.

The main advantage of collective financial responsibility is that it does not require the logistics and administrative costs of sorting or tracking products by individual brand. Collective financial responsibility is also the most practical way to fund the recycling of orphan waste. It is often not practical to assign individual financial responsibility to products whose manufacturers cannot be identified or who have gone out of business. The issue of how to best address orphan waste is discussed in more detail in the Dealing with Historic and Orphan Waste section of this report (see page 24).

Collective financial responsibility has two major drawbacks: an absence of incentives for environmentally-friendly product redesign and a bias towards certain types of manufacturers. In a collective financial responsibility system, any benefits from product redesign would be shared and diluted between all of the manufacturers. If an individual company was to design products that were more easily dismantled or recycled, the cost savings would result in a reduction of the overall cost of recycling and disposal. Therefore, an individual company may not have an incentive to incorporate end-of-life strategies into the initial product design. A partial exception would occur if costs in a collective system are distributed according to product weight. In this case, manufacturers would be able to benefit from designing their products to be lighter.

Supporters of market share argue that it is an appropriate financial mechanism because of the belief that current leaders in the electronics market have benefited from their predecessors and the future quantity of products to be processed is much higher than the existing e-waste.⁹¹ Even if this assumption is true, some manufacturers are concerned about the fair assignment of

responsibility. Distributing costs according to current market share may not be an accurate reflection of the products that are being discarded. Those manufacturers who had high product sales in the past and whose products are now being discarded benefit at the expense of new entrants or newer manufacturers that currently have high product sales, but whose products have yet to reach their end-of-life.⁹² This situation can create a bias against new entrants to the market, as they must bear the costs of those manufacturers who sold a great deal of electronic products in the past.

Market Share Based on Sales Revenue

Market share could be based on manufacturer sales revenue using either national or New York City sales data. Since sales revenue is a key measure of a company's success, this information is usually readily available, at least at the national level.⁹³ New York City sales data would provide a more accurate estimate of market share than national data, by reflecting the amount of electronic products actually sold within the City's boundaries. Sales data at the city level might also be a more fair measure because New York City may have different sales patterns from the national average. For example, the product preferences of New York City's unique industries such as publishing and web development might lead a company such as Apple to be disproportionately represented.⁹⁴

However, collecting city level sales data may be more difficult than obtaining national data. The Manufacturers Coalition on Responsible Recycling doubts the ability of manufacturers to be able to track location-specific sales data.⁹⁵ Because of the possible difficulty of obtaining city sales data, some supporters of the use of market share have argued for basing it on national sales data.⁹⁶ Many stakeholders like Apple and the Northeast Recycling Coalition support using national sales data to determine market share.^{97,98}

Market Share Based on Weight or Number of Products Sold

Another method to establish market share is to base it on the product weight or number of units put on the market by individual manufacturers. Each manufacturer would be required to report the number and weight of products sold to the organization that managed the program, who in turn would calculate the corresponding market share. The principle advantage of calculating market share based on the number of products sold or product weight instead of sales revenue is that these measurements may be a closer approximation of the manufacturer's actual physical presence in the market. While sales revenue may indicate the financial presence of a manufacturer within the industry, variations in product prices between brands can make revenue a poor measure of the volume of units sold.

Under a system of market share that is based on the number of products sold, manufacturers may not have incentive for product design change. However, if weight was the basis of market share, then there may be a design incentive favoring lighter products. While this motive could reduce the total amount of materials used, it may not necessarily lead to the use of less toxic materials. The use of weight or quantity of units as a measurement is discussed further in the following section.

Individual Financial Responsibility Through Return Share

Individual financial responsibility refers to EPR systems in which manufacturers only pay for the recycling costs of their own brand of products.⁹⁹ The most common measure of individual financial responsibility is called return share, meaning the tally of the number of products that end up in the waste stream from each manufacturer. The purpose of return share is to accurately reflect the number of products being discarded and to highlight any differences in recycling costs between brands. Return share can be established by periodic sampling¹⁰⁰ or from self-reported data.

Supporters of an EPR policy generally prefer individual financial responsibility because of its incentive to promote product redesign.¹⁰¹ If manufacturers are responsible for their products' entire life-cycle, they will directly benefit from the financial savings of reducing the products' end-of-life costs. Through individual financial responsibility, manufacturers have an incentive to make use of specialized expertise and resources in order to reduce their costs.¹⁰² Companies that recycle or reuse products the most efficiently will benefit over firms who do not. As a result, market competition among manufacturers may also lead to more efficient recycling systems. As manufacturers create products that are more easily recycled, recycling operators may compete to provide improved services at lower costs.¹⁰³ Thus, individual financial responsibility can lead to an overall change in the behavior and attitudes of manufacturers.¹⁰⁴

A major argument against individual financial responsibility is the sorting required to separate e-waste by brand.¹⁰⁵ Sorting or tracking requires a great deal of space as well as transportation and administrative costs. To avoid having to manually sort products, suggested solutions include more uniform brand labeling, bar codes, or other identification systems such as radio frequency identification.¹⁰⁶ While most manufacturers currently label their products, there is no single consistent format of labeling for product identification. An efficient sorting system might require uniform labeling standards so that products could be quickly and consistently distinguished. The cost of sorting and tracking can be avoided altogether through the use of a system that collects the products by brand, such as mailing items back directly to the manufacturer. This possibility is discussed further in the Physical Implementation section.

Return Share Based on Weight

The key advantage of weight-based return share is that product weight is an important determinant of recycling costs.¹⁰⁷ Apple Computer, Inc. claims that using a weight-based program will encourage companies to produce lighter products, reducing the overall cost of recycling.¹⁰⁸ Several take-back programs recognize that return share by weight is an accurate reflection of producer responsibility and have adopted its use. The Dutch computer take-back system bases financial responsibility on the weight of products being returned.¹⁰⁹ Under Washington's e-waste legislation (HB 6428), the Washington Department of Ecology would determine producer responsibility using return share based on weight.¹¹⁰

While basing a return share on weight is a widely used parameter, it has several drawbacks.¹¹¹ Newer products typically are lighter in weight than older products; therefore, basing responsibility on weight will bias financial responsibility towards more established companies who have had a longer historical presence in the market.

Return Share Based on the Number of Units

Instead of weight, manufacturer responsibility can be based on the number of units of a particular product type. Return share based on the number units may be desirable because changes in the design of a product may not always be reflected in a weight calculation.¹¹² The Institute of Scrap Recycling Industries, Inc. identifies two important design factors that are not necessarily dependent on weight: the amount of toxic contaminants used and the recyclability of the materials.¹¹³ Return share based on weight rewards the manufacturers of lighter products, regardless of the amount of toxics used.

Equivalent Share

Equivalent share is the term used to describe an EPR program where manufacturers are given a choice between individual and collective financial responsibility. Washington's e-waste law allows flexibility for each manufacturer to pay into a collective system or to "opt-out" and operate its own individual program. A manufacturer that opts out of the collective program will be assigned an "equivalent share" of products for which it will be responsible.¹¹⁴ Companies such as Hewlett Packard (HP) that already have the infrastructure to support a product stewardship program are supportive of the equivalent share concept.¹¹⁵

Equivalent share attempts to capitalize on the benefits of both an individual and a collective financial responsibility system. Manufacturers that have already established their own take-back systems, such as HP, should be encouraged to continue their own system. However, if a collective funding scheme would be more cost-effective for a company, it should be allowed to pay into a collective financial scheme. The outcome of equivalent share programs depends on how manufacturers choose to comply. Manufacturers that choose individual responsibility for their own brand of products would respond to strong product redesign incentives, as well as incur the sorting and tracking costs discussed above in the individual financial responsibility section. Similarly, manufacturers complying through a collective financial system would have weaker product redesign incentives, but would benefit from the lower administrative costs associated with collective financial responsibility programs.

Although equivalent share does not guarantee product redesign incentives, this uncertainty might not necessarily be a problem. EPR policy includes so many objectives that it is difficult to satisfy them all simultaneously. Using one policy mechanism for each separate policy objective can be more efficient than trying to solve all problems at once.¹¹⁶ Equivalent share satisfies the objective of shifting the cost of e-waste management from the government to manufacturers. Separate policy mechanisms might better address the product redesign objective, such as material bans modeled after the European Union Restriction of the use of certain Hazardous Substances Directive.

The difficulty in implementing an equivalent share funding mechanism is making sure that manufacturers are held responsible for their share. If a manufacturer does not meet the collection rate targets with its independent program, it may have to pay into the collective scheme to make up the difference.¹¹⁷ In order to mitigate the costs of ensuring that individual plans meet these targets, Apple suggests a system where all manufacturers are required to pay into the collective

financial system. Once a company could prove that its independent system was comparable, it would be able to reclaim a percentage of that fee.¹¹⁸

Recommendation

We recommend equivalent share financial responsibility because it is likely to be the most politically palatable option. The key advantage of equivalent share is the element of choice, since manufacturers can choose the most cost-efficient way to comply, based on their own situation. Support can be gained from manufacturers with their own take-back systems, who would oppose mandatory collective responsibility, as well as from manufacturers who would prefer collective responsibility over financing the take-back of their own products. Equivalent share is the lowest cost option to shift e-waste management costs from the public to private sector. The policy objective of encouraging product redesign is better addressed by a separate policy, such as a hazardous materials ban.

Dealing With Historic and Orphan Waste

Historic and orphan waste is one of the most important issues of an EPR policy, particularly because e-waste is one of the fastest growing components of the waste stream and many obsolete computers are currently stored in attics or closets by consumers.¹¹⁹ Historic waste is defined as any electronic products sold before take-back legislation is enacted. Orphan waste is a subset of historic waste that consists of products whose manufacturers are no longer in operation or cannot be identified.¹²⁰ Responsibility for orphan waste plays an important role in the choice between individual and collective financial responsibility.

Since individual financial responsibility holds manufacturers responsible for the end-of-life costs of their own products, assigning responsibility may be problematic when the manufacturer either cannot be identified or is no longer in operation. Collective financial responsibility is the most practical way to divide orphan waste responsibility between the current manufacturers. Even within a primarily individual financial responsibility program, collective responsibility may be used for orphan waste. Though some programs use market share to divide the costs of orphan waste, the return share calculation could also be used as the basis of dividing responsibility. An example of using return share to deal with orphan waste is the Dutch computer recycling system, which splits the costs for the orphan waste according to the manufacturer's share of the returned products.¹²¹ The distributional impact of using return share for orphan waste is a higher burden on large established manufacturers with high return shares, compared to new entrants whose products have to yet enter the waste stream.¹²²

Options for Physical Implementation

The process of physically handling e-waste occurs in four main stages: 1) collection and transportation, 2) sorting and tracking, and 3) recycling or reuse and 4) disposal. This section evaluates only the options for the first stage, collection and transportation. Although other locations with existing e-waste recycling programs frequently exhibit "shared responsibility" among consumers, municipalities and manufacturers, the purpose of this section is to evaluate the collection options for individual financial responsibility of manufacturers with a purely EPR

approach. The EPR policy assigns the entire financial responsibility to manufacturers, so any city or retailer participation in e-waste programs would be fully funded by the manufacturers.

Collection and Transportation Options

The first step in the proper physical management of e-waste involves the collection of the covered products. A successful EPR program in New York City would involve selecting the best option for the collection of items from the consumer, since organizing collection from private households is a key challenge in the e-waste recycling process.¹²³ A study of a drop-off collection sites pilot program in Minnesota found that collection and transportation costs accounted for 80% of the total cost of e-waste recycling.¹²⁴

Drop-off Collection Sites

This option involves designating locations throughout the City as collection sites with various hours of operation on a regular, if not daily basis. Residents would be required to physically bring items to the designated locations. The collection sites could be operated by DSNY, retailers, or a third party organization representing the manufacturers. In all cases, the full cost of the collection site would be paid by manufacturers.

Clean Production Action emphasizes that it is important for consumers to clearly understand how to dispose of their e-waste products.¹²⁵ Designated collection sites give consumers the convenience of disposing of their e-waste at anytime when the collection site is open, rather than just on designated collection days. Additionally, depending on the number of collection sites and the locations chosen, some drop-off collection sites could be quite convenient for some residents.¹²⁶

One important consideration in having designated drop-off locations is that many individuals in New York City rely upon public transportation. Therefore, requiring consumers to bring large, heavy, bulky, or awkward items to collection locations may not be feasible for many residents. The Public Advocate, Betsy Gotbaum, states that “it seems unreasonable to expect individuals to bring electronic equipment, which is often large and cumbersome, by bus and/or subway to designated drop-off sites.”¹²⁷ However, at least a minority of consumers are willing to haul their e-waste to a collection site. The Lower East Side Ecology Center has documented the creative use of rolling suitcases, dollies, and wagons by New Yorkers to transport e-waste to collection events.¹²⁸

Although collection sites run by DSNY are possible, retail store-based collection seems particularly attractive because of the number of retail stores in New York City. Retailer-based collection can use the concept of “reverse logistics,” where trucks delivering new products are used to transport old products to recycling facilities. In Minnesota, a pilot project found that 7.5% of consumers go to retailers because of the existence of a collection service.¹²⁹ Therefore, retailers may wish to participate in such a program, as they may find that it increases consumer trips to their store. The environmental justice organization WE ACT believes that a sustainable alternative to curbside pick up of e-waste is to have it received directly from retailers.¹³⁰

A potential problem with using retailers as drop-off locations would be the likelihood of retailer resistance to any plan that would make their stores into e-waste repositories. It might be difficult to accurately measure all of the retailer costs for which the manufacturer would be billed. Costs to the retailer could be significant, including the need for available storage space and employee time required to deal with e-waste.

Individual Manufacturer Mail Back Program

A mail back program would entail the consumer being responsible for arranging for a shipping container to be delivered to their home from the manufacturer, placing the item(s) in the box and scheduling or having the item available for pick up from an individual residence.

A major benefit of the mail back option is that it can be used to avoid sorting costs incurred by curbside pickup or drop-off programs. Products can be sorted by brand or even by specific model by providing the consumer with a shipping container with a different mailing label. As long as the e-waste item can be picked up directly from the consumer's home, the mail back option could be more convenient than the effort required for drop-off at a collection site.

A large drawback to this type of program is that many items may be too large, bulky, or heavy to send back by mail at a reasonable cost. For example, the cost of having one 17 inch Dell Cathode Ray Tube (CRT) monitor weighing 40 lbs picked up from Columbia University (zip code 10027) and mailed to Dell Corporate Headquarters in Round Rock, Texas (zip code 78682) is as follows:¹³¹

- \$24.58 by FedEx Ground
- \$30.72 by USPS Parcel Post
- \$38.55 by UPS Ground

Much of the existing stock of e-waste consists of old and heavy equipment. The good news for the mail back option is that CRTs are being replaced by lighter Liquid Crystal Display flat screens. Another promising trend is the growing market share of laptop computers, as laptops surpassed desktop computers in 2005 with 54% of the market share.¹³² Direct mail back is already a solid option for smaller e-waste devices and is becoming more feasible for computers.

Curbside Pickup

Curbside pickup in New York City would involve residents or building superintendents placing specified items in designated locations on the curb outside of consumers' places of residence. A curbside collection program could be operated by DSNY or a private recycling company. In either case, the full cost of collection would be paid for by manufacturers. The frequency of collection should be calculated based on the expected volume that needs to be collected. Some cities such as San Francisco, California have curbside e-waste collection, but only when specifically requested by a resident in advance, with a limit of two collections per year.¹³³

One benefit of having a curbside pickup program in New York City is that it makes it easier for consumers to participate. Participation in recycling programs has been shown to be closely related to the convenience to the consumer.¹³⁴ A recent survey on e-waste recycling in California has confirmed that convenience is a crucial determiner of consumer willingness to recycle.¹³⁵ The appeal of curbside collection is that consumers are already accustomed to

placing regular household waste in designated locations in their apartment building or on the curb outside their places of residence. A 1999 Environmental Protection Agency study of collection methods concluded that curbside collection programs tend to collect more e-waste per person than other methods such as one day collection events.¹³⁶

Despite the finding that curbside programs collect the most waste per person, the Environmental Protection Agency study found that curbside collection is the most expensive option in terms of the cost per pound of e-waste collected. The expense of curbside programs is attributable to the high cost of transportation necessary for collection.¹³⁷ However, the cost per pound of e-waste collected would likely be lower in New York City because high population density would result in more waste being picked up for each mile of the collection route.

Additional considerations for curbside pickup are problems with maintaining the integrity of the product. From previous experience with manufacturer-sponsored one-time collection events, DSNY estimates that about five percent of e-waste collected could be resold directly.¹³⁸ However, curbside pickup may leave valuable e-waste products subject to weather conditions. Units may become damaged from rain and snow while awaiting pickup on the curbside and lose any potential for reuse. One option to prevent potentially useful products from weather damage would be to take measures to protect the products from the weather, such as by placing the items in plastic bags.

Recommendation

We recommend curbside collection as a best practice in New York City because of the convenience and high collection rates associated with such programs. EPR legislation should not require manufacturers to use curbside collection, but manufacturers should consider it as an effective way of reaching collection targets. The actual party that should carry out the recycling should be decided by manufacturers; however, the party must be completely compensated by manufacturers and not coerced into cooperating with the collection program.

Conclusion

Electronic products such as personal computers, cellular phones, laptops and data management devices have improved consumers' lives in countless ways. However, the growing dependence on these products both at home and in the workplace has created a new environmental problem: electronic waste. Discarded e-waste is now considered one of the fastest growing components of the municipal waste stream, in large part due to the rapid increase in demand for electronic products and advancements in technology that encourage the obsolescence of current models. E-waste is of growing concern to policymakers, interest groups, and citizens alike because it contains toxic chemicals such as mercury, cadmium and lead, which are potentially hazardous to both human and environmental health. Extended producer responsibility is one policy approach that has been embraced as an effective method to address the e-waste problem, both within the United States and around the world. EPR policy extends the traditional environmental responsibilities that producers and distributors have to include management at the post-consumer stage, meaning the collection, recycling, reuse and disposal of e-waste.

The states of Maine and Washington have embraced the EPR approach and are in the initial stages of implementing EPR policies passed within those states. The Waste Electrical and Electronics Equipment Directive was passed by the European Parliament to mitigate the level of hazardous waste introduction into landfills from electronic products in Europe. New York City is the first city in the United States to propose a city-level EPR bill that requires manufacturers to develop a plan to collect and recycle electronic products they have sold in New York City. Int. 104 shifts the responsibility for managing e-waste from the local government to manufacturers, strives to encourage product redesign by forcing manufacturers to internalize recycling and disposal costs, and ultimately seeks to reduce the toxicity of the municipal waste stream.

Regardless of how an EPR policy in New York City is ultimately structured, existing EPR programs have provided many lessons for policymakers. Such experiences indicate that such a policy may be quite successful if the mechanisms by which it is implemented offer flexibility to those bearing the costs. Two main areas of responsibility to consider when examining EPR policy are the financial responsibility for the actual costs required to run the system and the physical responsibility for the act of collection, sorting and recycling. The research group recommends equivalent share financial responsibility because it is likely to be the most politically palatable option. The key advantage of equivalent share is the element of choice, since manufacturers can choose the most cost-efficient way to comply with the regulation, based on whether they have a comparable program in place or whether they will need to devise an alternative collection plan. The research group recommends curbside collection as a best practice in New York City for collection, sorting and recycling because of the convenience and high collection rates associated with current curbside collection programs.

Implementing an EPR policy in New York City presents a series of challenges. As EPR policies around the country are still early in their implementation stages, it is challenging to draw upon specific lessons learned and apply them to the New York City situation. Further research should examine specific cost data associated with the implementation of an EPR program in a city comparable in size and population to that of New York City. Finally, it is clear that the New York City Department of Sanitation, manufacturers and consumers will need to work together to ensure proper communication about their respective roles and responsibilities in the effort to mitigate the e-waste problem.

Appendices

Appendix 1. A Comparison of Electronic Recycling Laws/Programs

	Domestic		International
	Maine	Washington	European Union
<i>Legislation</i>	L.D. 1892	HB 2662 and SB 6428	WEEE
<i>Program type</i>	Both EPR and shared responsibility with consumers	EPR	EPR
<i>Which products are covered?</i>	CRT and flat screens greater than 4 inches diagonally and computer central processing units	CRT and flat screens greater than 4 inches diagonally and computer central processing units	10 product categories, including large and small household appliances, consumer equipment, lighting equipment, and electrical and electronic tools
<i>Who is physically responsible for the processes of collection, transportation, and recycling?</i>	Consumer delivers to waste to receiving station, Municipalities receive waste and deliver it to private consolidation facility, Consolidator ships waste to Department of Environmental Protection-approved recycling facility	The Washington Materials Management and Financing Authority is physically responsible unless a manufacturer has an approved plan to handle the collection, transportation and recycling independently	Manufacturers, but government has a role in collection in some member states.
<i>Who is financially responsible for collection, transportation, and recycling?</i>	Consumer pays \$2 fee, Municipality pays for operation of receiving station and shipping to consolidator, Manufacturer pays for cost of consolidating, shipping and recycling of waste	Manufacturers are responsible for financially supporting all of the programs activities.	Individual financial responsibility for manufacturers, but governments may pay for the transport of waste to the collection point
<i>Are there any collection goals?</i>	No	No	4 kilograms per person per year by end of 2006

Appendix 2. Industry E-Waste Recycling Initiatives and Programs

Some manufacturers and industry associations have independently begun offering their customers ways to recycle electronic products. The following is a partial list of the most current manufacturers and their voluntary steps to reduce e-waste:

- Apple Computer, Inc.: For consumers, an internet service is available for \$30 per item where the manufacturer arranges door-to-door shipping for the return of any make of computer hardware equipment. Beginning in June 2006, Apple will offer free take back when consumers purchase a new Apple computer.
- Best Buy: Best Buy has periodically partnered with multiple manufacturers to host in-store e-waste collection events and reports to have collected over 1.7 million pounds of e-waste since 2001.
- Dell, Inc.: For consumers, an internet service is available for \$10 per item where the manufacturer will arrange door-to-door shipping for the return of any make of computer hardware equipment. Dell also has a free take-back program for old computers when a new Dell computer is purchased. Finally, Dell reports to recycle hardware in an environmentally-sound fashion by sending it to one of their recycling partners who recycles or reuses parts or disposes of them in an environmentally-sound way. In addition, depending on the condition of the equipment being returned, Dell may donate the product to the National Cristina Foundation. The National Cristina Foundation works to provide second-life computers to individuals and students who are economically and socially at risk or living with a disability.
- Epson America, Inc.: Consumers can pay \$10 fee per Epson hardware unit returned, which includes shipping and recycling costs. The consumer then receives a \$5-off coupon per item returned, good toward any Epson product.
- Gateway, Inc.: Customers who recently purchased a Gateway computer can send in any manufacturer's computer and receive a rebate check based on an online trade-in estimate provided by Gateway, less the value of a recycling fee.
- Hewlett-Packard Development Company, L.P. (HP): For consumers, an internet service is available for between \$13 and \$34 per item, whereby the manufacturer will arrange door-to-door shipping for the return of any make of computer hardware equipment. HP operates two recycling facilities in the U.S., one in California and one in Tennessee.
- Lexmark International, Inc.: A free equipment recycling service is available to customers who ship end-of-life inkjet, laser, or multifunction Lexmark printers back to the company.
- Office Depot, Inc.: In 2004, Office Depot partnered with HP for three months and offered a free in-store e-waste recycling program. Collected electronics were recycled at one of HP's recycling facilities.

- Panasonic Corporation of North America: Co-sponsors electronic collection events with the EPA, electronic retailers, and industry associations. Panasonic was the 2004 recipient of the EPA “Program Champion” award in Electronics Recycling for its work in developing and expanding the collection and recycling of e-waste.
- Sony Corporation of America: Sony has a history of participation in shared responsibility programs and manages facilities in California, Alabama and Pennsylvania recycling consumer electronics, batteries, and cathode ray tube glass, respectively.
- Staples, Inc.: Staples offers a free in-store recycling program for cell phones, personal digital assistants (PDAs), pagers, rechargeable batteries and inkjet and toner cartridges. A portion of the proceeds from recycled products is donated to environmental conservation and public education organizations.
- Xerox Corporation: Xerox works with customers to reclaim end-of-life equipment and has internal components designed for multiple life cycles to allow end-of-life equipment to be rebuilt to as-new specifications. In addition, Xerox reports to reuse 70% to 90% of machine components by weight.

Appendix 3. Subjects for Further Research

Because extended producer responsibility (EPR) policies within the United States and the European Union are still early in their implementation stages, there is a lack of practical information pertaining to a few key areas of knowledge that would benefit policymakers, manufacturers, and local governments. These topics include: the costs borne by various parties involved in implementing current EPR programs, the lessons learned from the processes and, perhaps most importantly, how these programs have or have not been successful in reaching their performance goals. As more of this type of data becomes available, it will serve as a valuable source of information for regarding the development of EPR policy worldwide. The following discussions comprise a list of suggestions for further research specifically pertaining to a New York City EPR program; however, other parties interested developing EPR policy elsewhere may also benefit from more detailed analysis in these areas.

Cost-benefit Analysis of EPR Policy Implementation

Cost data is difficult to when comparing EPR programs because, for each program, “the strategies consider different legal frameworks, they cover different types and numbers of products, and the resultant mass flows and the related operational costs are highly context dependent variables.”¹³⁹ For example, different programs have varying definitions of what is considered recycling, different collection targets, and various rules about exporting. The collection and recycling cost for the UK implementation of the WEEE Directive is only \$200-\$292 per ton.

Despite the difficulty of making cost comparisons between existing programs, further research should examine specific cost data associated with the implementation of an EPR program in a city comparable in size and population to that of New York City. These expenditures would include the physical management of the program as well as its administration. Relevant to the cost-benefit analysis is also how much the City would save in disposal costs by reducing the amount of materials in the waste stream. A complex cost-benefit analysis would also attempt to quantify the benefits of reduction of toxic materials and would enumerate the specific costs to different stakeholders such as the New York Department of Sanitation, manufacturers and consumers.

Internet Sales of Covered Electronic Items

The issue of how to ensure that the collection, re-use and recycling of covered electronic items sold via the internet is adequately financed is an important issue that requires further research. Although not charging the consumer a fee at point of sale is what distinguishes EPR policy from the ARF method, the Manufacturers Coalition for Responsible Recycling has proposed that internet sellers should be allowed to add the cost as a separate fee so product pricing can remain consistent across the entire US market.¹⁴⁰

Transitioning From Collective to Individual Financial Responsibility

The European Parliament passed the Waste Electrical and Electronics Equipment Directive in August 2004. The directive mandates that electronic products introduced to the market before August 13, 2005 are deemed “historical” and are subject to collective financial and physical responsibility, while products introduced after that date are subject to individual manufacturer financial responsibility.¹⁴¹ The transition from collective to individual financial responsibility is an important policy tool that addresses historic or “orphan” waste. Thus, data pertaining to how manufacturers are managing the different levels of responsibility in Europe will be particularly beneficial to future parties faced with such a transition.

Informative Responsibility

The New York City Department of Sanitation will be directly affected if consumers do not properly comply with an EPR policy in the City; therefore, DSNY has an incentive to ensure proper communication with consumers and other parties regarding their roles and responsibilities in implementing the program. Further research should examine how manufacturers and retailers in New York City should educate consumers on proper electronic waste disposal methods. Apple Computer, Inc. has suggested that manufacturers, retailers and governments create one continually updated central database that consumers can access, which would contain information on what to do with a covered electronic device regardless of the manufacturer.¹⁴²

Additional Issues

- **Data privacy:** The collection and recycling of electronic products such as computers could endanger consumers through identity theft. An EPR program may need to include provisions to ensure that data is removed entirely from a hard drive before it is recycled.
- **Product coverage:** The list of covered products should be flexible to address new products that may become hazardous e-waste. However, this flexibility could create confusion regarding how to determine what products should be covered by the program.
- **New entrants:** Another important issue involves the ease with which new entrants can enter the market without being placed at an immediate disadvantage. The program may need to include safeguards to prevent compliance with the EPR program from forcing new entrants or less established manufacturers out of business.
- **Labeling requirements:** The EPR legislation or regulating authority must determine what labeling requirements should entail. A variety of options for labeling exists, including the following: each product could display a label listing the hazardous substances, each product could display a comprehensible symbol such as under the WEEE Directive, or each product could display a label that states the recycling requirements and contact information such as under the Maine law.
- **Export bans:** Once e-waste is shipped overseas, the City has no method of monitoring the recycling fate of the products.^{143,144} An export ban attempts to reconcile this flaw;

however, this restriction stretches constitutional limits and may lead to legal delays and entanglements.

- Federal program: Additional research should assess the likelihood of the implementation of a federal EPR or e-waste recycling program. In addition, it would be useful to know how a federal program would impact existing state and municipal programs, as well as manufacturer programs.
- Business-to-business transactions: Business-to-business transactions occur when one business gives products to another business. The concern here regards how businesses would dispose of or donate their e-waste, particularly if the products were still in good working condition. The EPR program must consider whether or not e-waste from a business should be treated differently than e-waste from an individual consumer.

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