Economic and Financial Issues of End-of-Life Electronic Waste

In response to the legislature passing ESHB 2488, Ecology, in conjunction with the Solid Waste Advisory Committee (the "SWAC") has been asked to consider alternative scenarios for managing E-Waste. This paper provides background regarding economic principles, recycling costs and alternative financing schemes to consider in the forthcoming process.

Alternative programs for managing E-waste usually involves tradeoffs such as increased retail prices, reduced environmental damage and impacts to future generations. Consideration of all costs and benefits and the role of sustainability and other equity issues play a critical role in considering end-of-life options for E-waste. Economic impacts are also important in considering the particular type of financing system. For example, requiring manufacturers to pay for recycling programs will tend to increase awareness among manufacturers about the impacts of product design on recycling and disposal. This is in contrast to the typical solid waste management system that involves consumers paying for waste disposal at the end of product life. Consumers are unlikely to consider waste expenses in their purchasing decision since it is such a small portion of their budgets and because it will often not be incurred until some time from the purchase date.

ESHB 2488 requires Ecology in consultation with the SWAC to research and develop recommendations for implementing and financing an electronic product collection, recycling and reuse program. Though ESHB 2488 emphasizes an electronic recycle and reuse program, a requirement to evaluate the possibility of landfilling covered electronic waste requires analyzing disposal.[1]

The following paper first provides an introduction to economic principles relevant to E-waste management and addressing broadly the alternative techniques for managing end-of-life electronics. The second and third sections briefly address two specific questions in ESHB 2488:

1. Review existing data on the costs to collect, transport, and recycle waste (Sec. 3(c))
2. Develop and assess ways to finance a statewide collection, reuse and recycling program for covered electronic waste.

The financing alternatives provided are not specific alternatives but more broadly consider the classification of alternative financing arrangements available. More specific alternatives will be considered in the future.

[1] Section 3(c) states "Evaluate the suitability of lined and unlined facilities for the disposal of covered electronic products."

I. What are the Cost and Benefits of End of Life Options for E-Waste?

Introduction

What to do with end-of-life electronics is likely to become a growing consideration for many communities in the United States including those in Washington. Consumers that are facing the decision of what to do with an electronic product that is no longer useful will have to consider the various reuse, recycling and disposal alternatives available. Should it be placed curbside for pick-up by the local waste hauler, donated to charity or simply placed in the attic in case it's needed in the future? Government can influence this decision by creating programs that alter the relative desirability of these choices. This is justified if the social benefits from the program are greater than any additional costs it may impose on society.

Internal vs. External Costs and Benefits

The production, use and disposal of televisions, PC's and other electronic devices involve tradeoffs for society. The materials, energy and labor that go into manufacturing these devices are paid for via the price paid by the consumer at the time of purchase. Upon completion of the useful life of these products, consumers often utilize the solid waste system to remove and dispose of the item. The costs associated with hauling, landfill construction, maintenance and labor are paid for in the fees charged the solid waste consumer. Both of these costs are often referred to as the "internal costs" which are those costs market participants directly incur, or are compensated for, in any given transaction.

Often there are other costs associated with an economic activity known as "external costs". These are costs that are not directly incurred by those involved in a transaction like buying or selling a PC. Examples of these costs relevant to electronic waste are air and water pollution generated during the production of these goods, pollution from leachate associated with landfilling the waste material, and carbon dioxide emissions from transportation of the waste. These are costs in the sense that they degrade the ability of our environment to provide services such as clean water, waste absorption and maintenance of global climate, but are usually not valued or accounted for in market transactions between the parties and are borne by those external to the transaction.

Similarly to the internal and external costs mentioned above, there are internal and external benefits from alternatives. Those that recycle materials will receive the internal benefit of acquiring valuable material that can be sold on recycled material markets. This will result in less waste in landfills that will reduce the likelihood that contamination will occur. This will benefit those that are not direct parties to the transaction and can be considered an external benefit.

In considering the optimal policy for managing E-waste, it is important that both internal and external costs and benefits are considered. Neglecting external costs will make it highly unlikely that a socially optimal policy will be adopted.[2] Neglecting internal costs will make it difficult for stakeholders to support the process.

[2] A significant problem with external costs is that they tend to be difficult to measure. Often they are presented in qualitative form to increase the likelihood they are explicitly considered in policy-making.

Efficiency and Equity

The above discussion of internal and external costs and benefits has both economic efficiency and equity components. Consideration of all costs and benefits is more likely to lead to a policy that uses our resources (e.g. as inputs for produced goods, to remove wastes, etc.) in a way that provides the greatest benefit for society. It is also likely to help ensure that all parties potentially impacted by proposed policies are considered, whether they be directly involved through markets or indirectly involved via external costs and benefits.

An example of this relationship is the concept of "sustainability." Will use of non-renewable materials today reduce the ability of future generations to have as high a quality of life as the current generation?[3] This is primarily an equity criterion since it is focused on what is a fair allocation of resource use among different groups. Obviously, it is a difficult question to answer since future generations can't articulate their desires and we don't know what role non-renewable resources will play in the economy of the future. However, decisions that aren't made explicitly are made by default and so it is important to consider this question in any discussion of resource use. Once this question has been answered and a discussion of the resource implications completed, then the allocation that maximizes the benefits of resource use (i.e. the efficient allocation) for all generations can be considered.

Baseline

Table 1 contains a description of internal and external costs and benefits from alternative end-of-life options for e-waste.[4] In order to evaluate the relative merits of different end of life options, it is necessary to consider which alternative should be used as a baseline from which to measure the other alternatives. For the purpose of this descriptive analysis and the summary in Table 1, it is assumed landfilling of e-waste as municipal solid waste (MSW) is the baseline from which all alternatives are measured. This would represent minimal policy intervention by governments and could be considered to be the "status quo". However, several local governments in Washington have banned the disposal of electronic waste in landfills. In those cases, landfilling is not a viable alternative.

End-of-Life Options for E-Waste

Owners of computers and TVs that reach the end of their useful lives have several alternatives. In general, these can be broken down into waste disposal, re-use or recycling that may or may not involve re-use. Several studies indicate that many consumers store their computers after replacement or use their TV's in secondary locations. Storage and re-use can be considered as alternatives that delay the waste disposal or recycling decision. The alternatives presented below assume consumers are electing to remove the electronics from their households.

[3] A criterion of having future generations no worse off than current generations is one definition of "sustainability." Others have been suggested.
[4] External costs and benefits are stated qualitatively since there is no market price available. Techniques exist for estimating these values, but the results are highly situation specific.

Waste Disposal

Disposal of E-waste involves either leaving it to be picked up by waste haulers or dropping it off at transfer stations or drop boxes. This material will either be hauled to an active landfill or waste-to-energy (W2E) facility. The material (or residual from the W2E facility) will end up in a landfill with a conventional liner but will be subject to rainfall and the potential for leachate creation. Leachate and the long-run possibility of liner failure can potentially lead to environmental damage. Treating this material as hazardous waste may reduce this possibility.

Disposal of E-waste as municipal solid waste (MSW) is probably the cheapest option in terms of internal costs for the consumer. Tipping fees in Washington typically range from \$30-\$110/ton depending on the county and the landfill.[5] If this material is handled as hazardous waste, then the price increases substantially to approximately \$2,000 per ton.[6] Increasing use of landfills for e-waste could lead to an increase in tipping fees since the material is very bulky and could potentially increase the rate at which landfills reach the end of their service life. This increasing disposal cost will also increase the incentive for illegal dumping.

In both cases (treating e-waste as MSW or hazardous material) the costs listed above are the internal costs experienced by those generating or disposing of E-waste. External costs associated with landfilling include the increased risk of environmental contamination from leachate and failed liners. A requirement that the material be considered hazardous waste would tend to reduce this risk since it would likely be treated more carefully. This could be considered an external benefit.

As mentioned previously, landfilling may not be an option in some communities. In many of the more urbanized western Washington counties, E-waste is either banned or restricted which will severely limit the amount of material placed in landfills.

Re-Use

Another alternative for those with TVs and PCs is re-use. A considerable number of PCs are being donated to charities and this has the potential of being a significant revenue source. However, it has also become a burden as many of the donated machines are not functional. The costs associated with this alternative are those associated with linking buyers and sellers (i.e. "transactions costs"). Direct costs of re-use are the time and travel costs of taking the computer to the charity or the pick-up site and the travel cost for the charity of hauling the computer to the store and pricing, exhibiting and selling it. Lastly there is a cost associated for the buyer for time and travel costs of transporting it to their homes. Though some of these costs may not be monetized, they are internal costs borne in the market.

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[5] From the 1999 Washington State Solid Waste Survey. These are the current (1999) values for tipping at landfills and do not include collection costs. Collection costs typically range from \$30-\$120/ton.
[6] From U.S. EPA Region 9, "Computers, E-Waste, and Product Stewardship: Is California Ready for the Challenge?

Re-use may also occur via computer recyclers. Recyclers sort the CPUs and monitors that arrive for re-sale either overseas or domestically. These are then directly re-used or salvaged for components. This is further discussed below under recycling.

Cost data for re-use is difficult to find. In the Minnesota Demonstration Project (MDP), recyclers were paid for the machines they could ship overseas. Net revenues for computer monitors and CPUs were $1,100/ton and $2,000/ton respectively. However, this is simply an intermediate cost of re-using computers and does not reflect the total cost.

Re-use is appealing since it delays the use of new materials, delays the construction of new landfill space and may increase economic efficiency. How it affects waste management in the long run depends on how long the computers are used and what happens with them when they are no longer valuable to the new owners. For example, overseas re-use could lead to greater environmental damage depending on what happens to the equipment at the end of its life and landfilling standards in the destination country.

Recycling

Another end-of-life alternative is recycling. This may involve curbside pick-up, recycling event days, and/or manufacturer or retailer take-back programs. Recyclers' take-in computers and either disassemble them or re-sell them. The disassembled materials include plastics, CRT glass, circuit boards, insulated copper wire and copper yokes, steel breakage (chassis) and waste and much can be sold in secondary materials markets to smelters, CRT glass manufacturers, and plastics manufacturers. In general, the cost of recycling is highly variable ranging from about $200 to $1,000 per ton in other U.S. communities[7] depending on how the material is collected and the specifics of the local recycling market.[8]

Recycling programs vary significantly. A pure public program might combine collection, processing, administration and marketing of all types of electronic waste. Various combinations exist as some programs don't provide collection or use private firms to provide collection. Some simply administer a program where the various services are provided by various private companies. The common characteristic is that funding for the program comes from the public in the form of some type of solid waste management fee.

Private programs also vary a lot. Some programs involve retail take-back programs that involve collecting machines and forwarding them to recyclers or collecting advanced fees and using the fees to pay for a program to recycle electronics. Other programs involve producers taking back machines and either recycling components or funding a centralized organization to recycle machines. These programs are linked since they are funded through a fee (either visible or invisible) that the consumer pays upon purchase of a machine. Public-private programs involve a combination of the above programs.

[7] Some communities have reported lower costs. See "Setting up & Operating Electronics Recycling/Reuse Programs: A Manual for Municipalities & Counties", NERC, 2002.

[8] This cost data represents several types of publicly provided programs. Data on privately provided programs is still being obtained.

Recycling has several external benefits including reduced risk of groundwater contamination associated with landfilling, reduced pollution associated with virgin material extraction and reduced use of virgin materials.

Table 1 contains a description of the alternatives and the internal and external benefits.

Table 1. Internal and External Costs and Benefits of E-Waste Disposal Options[9]

Option	Internal (Private) Cost Burden	Internal (Private) Cost	External Cost Description	External Cost Burden	External Cost	External Benefit Description	External Benefit Burden	External Benefit
Disposal								
Standard landfilling	Paid by consumers/businesses and implemented by local government	\$60-\$230/ton[10]	Risk of env. release	Those living near landfills, future generations	Varies with site, material, etc.	N/A	N/A	N/A
Haz. Waste	Paid by consumers/businesses and implemented by local government	\$2,000/ton[11]	Risk of env. Release, increased illegal dumping	Those living near landfills, future generations	Varies with site, material, etc.	Reduced risk of env. release	Those living near landfills, future generations	Varies with site, materials, etc.
Re-use								
	Paid by consumers/businesses and implemented by non-profits, local government	**(?)**	External transportation costs, end-of-life question at destination	Those living near landfills, future generations	Varies based on site, material, etc.	Delayed/Reduced risk of env. Contamination, delayed/reduced use of virgin materials	Those living near landfills, future generations	Varies based on site, materials, etc.
Recycling								
U.S. or Overseas	Paid by consumers and businesses that use/produce PCs or by taxpayers that may or may not use PCs	\$200-\$1,000/ton	N/A	N/A	N/A	Reduced risk of env. Contamination, reduced use of virgin materials	Those living near landfills, future generations	Varies based on site, materials, etc.

[9] All assessment of external costs and benefits are relative to the option of landfilling as municipal solid waste. The internal benefit is the value individuals and businesses place on E-waste removal.
[10] Tipping fee component from 1999 Washington State Solid Waste Survey. Garfield, Grant & Walla Walla counties' fees are below \$30/ton, and Ferry and San Juan have fees above \$110/ton. Transportation costs are assumed to range from \$30-\$120/ton.
[11] From U.S. EPA Region 9, "Computers, E-Waste, and Product Stewardship: Is California Ready for the Challenge?

II. What are the Costs and Revenues Associated with Electronic Waste Recycling[12]

The cost of recycling electronic waste is highly variable and the data available is relatively scarce. Recycling used electronics involves up-front program development costs and operating costs which include staff, publicity, transportation, advertising, recycling fees, and maintenance.

Program Development

Program development costs include such costs as staff time, supplies, equipment and permitting. The size of the cost will depend on the details of the program design. A program involving a relatively simple extension of an existing program (e.g. adding an electronics collection container at an on-going collection recycling center and electronics recycling/reuse markets readily available) should require nominal costs. However, if a program requires creating an entirely new program, extensive market analysis, publicity, equipment and staff time, then program development costs will be much higher.

The Northeast Recycling Council (NERC, 2001) surveyed nearly 500 communities to determine costs (among other attributes) associated with existing programs. Out of the 176 completed surveys, 80% spent less than $5,000 in program set-up.[13]

Operating Costs

Operating costs can be broadly broken down into administration and publicity, collection/transport and recycling fees.

Administration and publicity costs for programs include the staff time of operating a program on an on-going basis and the fees necessary to advertise collection events or on-going programs. Little data is available on these aspects and these values are not included in the cost estimates below except for the case of Minnesota's Demonstration Project. In that study, planning, publicity and operating costs (not including collection, transportation and recycling fees) amounted to $288/ton.

Collection and Transport costs form a significant part of the cost of an E-waste program. Electronic waste tends to be bulky and fragile and so is quite costly to collect and haul to a recycler. The costs will also vary a lot based on whether the consumers are expected to bring their waste to a central location or whether it is curbside pick-up. It is important to note that transportation costs are borne either way, it's just whether they are monetized or not.

The Massachusetts state contract for E-waste provides two contracts for municipalities, one for recycling only and one that includes transportation. The difference in cost between the two contracts is $200/ton for mixed CRT and computers if the total yield is between 200 and 2,000 pounds and $0/ton if it is greater than 2,000 pounds.

Table 2 below contains electronic waste program costs for selected programs.

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[12] ESHB 2488 Sec. 3(c)-Review existing data on the costs to collect, transport, and recycle electronic waste

[13] "Setting Up & Operating Electronics Recycling/Reuse Program: A Manual for Municipalities & Counties," Northeast Recycling Council, 2002.

Table 2. Selected Electronic Waste Recycling Program Costs

Program	**Cost**[14]	**Description of Cost Data**	**Source**
Minnesota's Electronics Recycling Demonstration Project	$448/ton	Planning, publicity and operating =$288/ton Transport, Processing and Marketing =$160/ton	"Recycling Used Electronics- Report on Minnesota's Demonstration Project" Minnesota Office of Environmental Assistance, 2001
San Jose, CA	$580/ton	Transport, demanufacturing & disposal	"Analysis of Five Community Consumer/Residential Collections End-of-life Electronic & Electrical Equipment", U.S. EPA Region 1, Common Sense Initiative, EPA-901-R-98-003, 1999
Somerville, MA/Binghamton, NY	$160-$880/ton	Transport & demanufacturing	
Union County, NJ	$200-$660/ton	Operating, transport, demanufacturing & disposal	
Hennepin County, MN	$1,000/ton	Operating, transport, demanufacturing and disposal	
Napervile/Wheaton, IL $200-$1,000/ton	$260-$660/ton	Transport, demanufacturing & disposal	
NERC National Survey of 176 municipal programs	-$20-$1,100/ton $330/ton (average)	Recycling fees only	"Setting up & Operating Electronics Recycling/Reuse Program: A Manual for Municipalities & Counties", Northeast Recycling Council, 2002
	$374/ton (average)	Staff, publicity, transport & recycling fees	
Massachusetts State Contract	$260-$300/ton	Recycling fees only	"Massachusetts State Contract CRT Pricing Memorandum", August 31, 2001

<u>Recycling</u>
The demanufacturing costs vary a lot depending on whether the materials are TVs, CPUs or monitors. In the case of CPUs, it may be possible to demanufacture these at a profit, but TVs may be costly to demanufacture. The value of a computer to a recycler varies based on whether it can be re-used or will be disassembled for recycling. Specific materials are derived during the recycling process. These include:

[14] None of the costs listed include the initial set-up fees. The NERC survey found that 80% of the programs that responded spent less than $5,000 in set-up fees.

Plastic: Plastics can be separated by resin type and the chemical and mechanical properties developed for each material. This material can then be re-used as a replacement or additive to virgin resins.

CRT Glass: Glass from collected CRTs can be sold to traditional smelting markets for glass to lead recycling or to glass-to-glass recycling markets that return CRT cullet to the CRT manufacturing process.

Exports (Re-use): Some components can be sold to overseas markets for potential reuse, repair or component recovery. In the MDP, overseas markets paid a net $0.10 per pound for CPUs and a net $0.55/pound for computer monitors which was a greater return than domestic recovery markets

Circuit Boards, Copper Wires & Yokes: Metal bearing parts can be sent to copper smelters which separate the precious metals from other parts of the item and return to elemental form.

Steel Breakage: The carcasses of the waste can be sent to auto shredders. Preliminary analysis indicates this is not cost effective.

Waste: The remainder of the material must be landfilled.

A breakdown of unit costs for recycling/reuse of TVs, monitors and CPUs as determined from the MDP is provided in Table 3 below.

Table 3. Net Revenues from Recycling for TVs and PCs ($/lb) From the Minnesota Demonstration Project

Item	**Revenue (cost), $/lb**
Televisions	
Plastic (HIPS)	$0.06
CRT Glass (Lead Recovery)	($0.045)
CRT glass (Glass Reuse)	($0.025)
Low-grade circuit boards	$0.125
Insulated copper wire	$0.120
Copper yokes	$0.115
Steel breakage	$0.020
Waste	($0.030)
Gross Revenue ($/lb)	***$0.005***
Gross Processing Costs	***($0.034)***
Net Revenue ($/lb)	***($0.029)***
Computer Monitors	
Plastic (ABS & HIPS)	$0.06
CRT Glass (Lead Recovery)	($0.045)
Export (Reusable)	$0.055

Low-grade circuit boards	$0.125
Insulated copper wire	$0.120
Copper yokes	$0.115
Steel breakage	$0.030
Waste	($0.030)
Gross Revenue ($/lb)	***$0.022***
Gross Processing Costs	***($0.013)***
Net Revenue ($/lb)	***$0.009***
Personal Computers	
Plastic (ABS & HIPS)	$0.00
Power Supplies	$0.115
Export (Reusable)	$0.100
Insulated Copper Wire	$0.135
Printed Circuit Boards	$1.25
Steel breakage	$0.030
Waste	($0.030)
Gross Revenue ($/lb)	***$0.13***
Gross Processing Costs	***($0.03)***
Net Revenue ($/lb)	***$0.109***

As can be seen, some aspects of recycling are performed at a net cost, whereas others can be done at a net profit. In general, it appears that CPUs can be recycled at a net profit, whereas monitors and televisions are costly to recycle.[15] Table 4 indicates the demanufacturing value of selected electronics based on current information.

Table 4. Demanufacturing Value of PCs and TVs

Value of Computer (Assuming PC & monitor weigh 60 lbs.)	
Derived from MDP	$7.08/PC
Other estimates[16]	$25-30/PC
Value of TV (if recycled) (Assuming 90 lb. model)	($2.70)/TV

The values represent the net value of recyclable material within a PC/TV. As can be noted, computers appear to have positive value, whereas TVs can only be recycled at cost.

[15] Monitors can be profitable if they are re-sold overseas. All costs noted are internal costs.
[16] From MCC Electronics Industry Roadmap (1996), GreenBiz website on computer recycling; www.greebiz.com/toolbox/essentials_third.cfm?LinkAdvID=4159.

III. How Are Electronic Waste Management Programs Typically Financed?[17]

Introduction

Programs for managing end-of-life electronic waste will require revenue to pay for the internal costs associated with recycling, re-use and/or disposal. The success of the system will be directly dependent on how much it costs and how the funding is obtained. Moreover, the financing techniques will also determine who pays and may also impact the extent of external costs borne by society.

Financing solid waste programs has changed significantly over the years. Common practice in the past was simply to charge a flat fee for waste management. Increasing environmental regulations together with difficulty developing new landfill space led many to consider consumer behavior and techniques that might encourage waste reduction. Many municipalities adopted disposal charges in the 1990s as a way to link the waste generated with the cost of providing the service. So called "pay-as-you-throw" financing schemes went into effect where it became common to pay for garbage disposal based on the amount created.

Paying for waste disposal based on unit costs is a useful step forward, but it does not provide any incentive at the manufacturer's level to reduce waste associated with packaging and the design of the product. Consumers are unlikely to take into account the costs of waste disposal when purchasing a new item, because the cost is a small part of household expenditures and in the case of a longer-lived good like a television or PC, it is not incurred until well into the future.

Extended Producer Responsibility (EPR) techniques are an effort to alleviate this problem by making producers physically and financially responsible for the environmental impacts their products have at the end of the product's life. This technique makes extra packaging and larger components a direct cost of producing goods by requiring manufacturers to take back their goods and recycle/dispose of them. This makes end-of-life recycling/disposal a production cost and encourages manufacturers to reduce the quantity of waste or facilitate recycling in product design.

Financing: Nuts and Bolts

A financing system can be thought of as having three primary functions: generating revenue, allocating costs and providing incentives. The revenue generation function requires a system that provides for sufficient and stable revenue that adjusts as the amount of end-of-life E-waste expands and the economy fluctuates. It also should be easy to administer. In the case of electronic waste, the system (whether disposal, re-use or recycling) will require a stable and sufficient source of revenue to pay for planning, collection, demanufacturing and disposal.

[17] EHSB 2488 Sec. 3(i)-Develop and assess ways to establish and finance a statewide collection, reuse, and recycling program for covered electronic products

The cost allocation function must consider equity and efficiency. Equity involves considering the allocation of costs in a manner that is consistent with accepted norms. Economic efficiency should reflect the social and private costs of providing service to different users. For example, an electronic waste program that obtains revenue from all participants in a solid waste program is unlikely to be efficient since some participants may not own computers. Requiring them to pay for electronic waste recycling is a cross-subsidy that is unlikely to be efficient.

Lastly, the financing system should provide incentives that are compatible with efficiency and waste reduction. For example, end-of-use fees provide no incentive for manufacturers to consider the amount or toxicity of waste in their products or the ease with which it is recycled. EPR programs tend to make manufacturers consider their production processes since the cost of recycling becomes another type of production cost.

As mentioned above, end-of-life electronic waste can be managed either by paying for it at the end-of-life, paying for it up-front or some combination. A brief outline is provided below.

<u>End-of-Life Fees</u>
End-of-life fees are the predominant technique used in managing solid waste for most communities in Washington. Use of these fees to support an E-waste program would likely involve a relatively simple extension of the local solid waste management program. This could support either disposal or recycling of e-waste and it could be paid either as part of the existing solid waste fees paid by consumers or as a unit fee at the time of pick-up or drop-off. These types of programs would likely be administered by the local solid waste management agency and could involve curbside pick-up programs, drop boxes or collection events.

An advantage of this type of fee is that it is relatively easy to administer and fees could be adjusted to reflect the cost of the system as required. Revenue would likely be as stable as revenue for the existing system. For those communities that ban landfilling of electronic waste, these materials would have to be hauled to a recycler which may increase the program cost.

A significant disadvantage of this system is the incentives it provides. Consumers that are deciding what to do with end-of-life electronics can store them, give them to charity, recycle it or disposal of it legally or illegally. Raising the cost of recycling will tend to make the other alternatives more attractive which may encourage more disposal. Raising the cost of disposal may encourage more illegal disposal. If fees are assessed based on a flat fee to property owners, then cross-subsidization will occur where those that aren’t disposing of E-waste are subsidizing those that are.

Manufacturers are also not encouraged to act in ways that promote waste reduction. Since the fees for disposal are relatively small and not incurred by the consumer until well into the future, consumers are unlikely to consider the cost of disposal in their purchasing decision. Therefore, manufacturers get no indication from the market that devices that generate less waste are desired by consumers and have no incentive to consider the recyclability of the product or the amount of waste produced.

Up-Front Financing

An alternative approach is to require disposal/recycling fees be provided up-front. Financing up-front requires that the consumer pay for disposal at the time they purchase their new electronic equipment either in a visible charge or as part of the purchase price.

Up-front programs with visible fees involve collection and submittal to a public account where it is used to pay for processing of materials. These programs require a governing body to mange the account and pay for collection and processing and advertising. The retailer collects the fee from the consumers at the sale point and the consumer can use any part of the collection system provided free of charge.

Programs with invisible charges are the responsibility of the manufacturers. They are required to develop and implement a program for collecting and recycling their products. This can be done either individually by each firm or collectively within the industry through a third party. Retailers in this system typically have no responsibilities. Consumers pay for the system within the purchase price of the computer and then must use whatever system is provided by the manufacturer free of charge.

Both of these systems have the advantage that they will tend to encourage manufacturers to consider the waste they produce. However, the visible fee program will only be successful if the fee can be adjusted to reflect greater recyclability of products over time. This would only occur, if similar efforts were made by all manufacturers. The invisible charge system should be much more effective in encouraging manufacturers to consider waste and recylability in production since it becomes a cost of production.

The visible fee system has the disadvantage of requiring the retailer to collect fees and the associated extra administrative costs. It also may not provide very large incentives for producers to consider product design. The invisible fee design might lead to a patchwork of different programs that will be difficult for consumers to understand and will not provide a way to consider electronic materials from manufacturers no longer in business ("orphan waste").

Combined Approaches

Some programs have considered some combination of the end-of-life programs or a combination of up-front and end-of-life systems. Some have considered starting with a visible front-end fee and then transitioning to an invisible fee program. This allows manufacturers time to set-up and establish a program and provides near-term funding for orphan waste.