Iowa Electronics Waste Characterization Study
FINAL REPORT

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Submitted by:
Wuf Technologies, LLC
7 South State Street
Concord, NH 03301
603-224-7959 / fax 229-1960
email mail@wuftech.com

Submitted to:
Iowa Department of Natural Resources
Attn: Merry Rankin
Waste Management Assistance Bureau
502 East 9th Street
Des Moines, IA 50319

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EXECUTIVE SUMMARY

This study was undertaken to address the significant waste management and environmental issues represented in the large and growing number of personal computers, computer monitors, televisions, and related equipment entering the Iowa waste stream. Computers and related electronic equipment are one of the fastest growing segments of the municipal and commercial waste stream, in Iowa and nationwide. Environmentally, they are a concern for several reasons, principally leaded glass in computer monitors, and lead, mercury, and other heavy metals in a wide variety of electronic equipment.

The study was designed to address a series of related questions:

1. How many computers are being discarded by Iowa residents and businesses?
2. What recycling options are available for used electronic equipment in Iowa? Is the availability of recycling options different for different generators?
3. What are the barriers to electronics recycling for Iowa generators? Are they different for different generators?
4. What equipment and which generators should be the highest priorities as the State considers attempting to expand the availability of recycling opportunities for electronics?
5. What policy options are available to the State to address these high priority generators and their electronic equipment wastes?

CURRENT ELECTRONIC EQUIPMENT WASTE GENERATION RATES

This study estimates that approximately 274,000 personal computers or their equivalents were generated as waste in Iowa in 2001 (Table ES-1). When related equipment including monitors, keyboards and mice are accounted for, this equates to an approximate quantity of 9,900 tons of electronic equipment waste. This value can be expected to double by 2005.

Table ES-1
Estimated Discards of Computers and Related Electronic Equipment in Iowa, 2001

Sector	Estimated 2001 Discards, PCs or Equivalent	
	Number	**Weight (Tons)**
Commercial / Institutional	175,000	4,400
Residential	99,000	2,500
Total	274,000	9,900

Note:
Estimated weight of approximately 50 lbs/system includes monitor (approximately 25 lbs) plus CPU, keyboard, and mouse (approximately 25 lbs).

Televisions are another waste stream of concern. With an average of over 35 million units sold per year through the 1990's, the number of TVs purchased annually by American consumers is nearly triple the number of personal computers (despite the rapid growth in PC sales throughout the decade) (Electronic Industries Alliance, 1999). In a statewide pilot electronics recycling program in Minnesota, TVs returned for recycling outweighed PCs by a factor of five. Although the number of TVs retired nationally or in Iowa was not specifically estimated for this study, it is clear that the need and demand for TV recycling options is at least as great as demand for computer recycling options. This situation will be exacerbated in coming years

as the TV industry and consumers convert fairly rapidly to high-definition television, a transition expected to begin by about 2003.

CURRENT ELECTRONIC EQUIPMENT MANAGEMENT PRACTICES

Commercial / Institutional Sector

Table ES-2 summarizes information on management of surplus computers derived from Iowa firms. Forty percent of 30 reporting firms donate some or all of their equipment or attempt to do so. Over half report that they dispose of all or some of their surplus computers and electronic equipment (CEE), or store it because they have no better alternative. Only two firms report third-party recycling as a means of disposing of surplus CEE. Six firms return equipment to the company that leased or sold them the equipment (3 firms), or report that disposition is handled by their parent companies (3 firms). Another six firms report that they give or sell used equipment to employees, and one reports in-house scavenging for parts as a major means of disposal. One-third of all firms reported that they use multiple means of disposing of used equipment.

Table ES-2
Means of Disposing of Surplus Electronic Equipment Among Thirty Iowa Firms

Means of Disposition	Number	Percent
Donate	12	40%
Attempt to Donate	2	7%
"Recycle"	2	7%
Give/Sell to Employees	6	20%
Scavenge for Parts	1	3%
"Dispose"	9	30%
Warehouse Indefinitely	7	23%
Return to Firm that Leased or Sold Equipment	3	10%
Handled by Parent Company	3	10%

This information is consistent with data gathered elsewhere in the country. In general, a few broad patterns characterize the current status of CEE recycling in the private sector.

- Larger firms tend to manage their electronic surplus better than smaller firms. Smaller firms are much more likely to report storage or disposal as their primary means of disposition.
- Large firms tend to have more disposition options. This results from a combination of factors: (1) more staff and resources available to devote to recycling; (2) more awareness of the potential liabilities associated with improper disposal; (3) greater volumes of surplus, which attract recycling firms; (4) more momentum toward equipment leasing with connected takeback provisions.
- There is a definite trend toward leasing CEE, with integrated end-of-life takeback, particularly among large firms (although, to date, far less than a majority).
- Many firms don't have any sort of plan for disposing of surplus CEE, or reliable information about what disposition options are available.
- Donation absorbs only a small fraction of potentially available equipment, and is unlikely to develop into a major outlet for surplus electronics.

Residential Sector

Throughout the U.S. as in Iowa, residential electronics recycling is in its infancy. A detailed analysis by the Northeast Recycling Council identified fewer than 500 residential electronics recycling programs that have operated in the U.S. from 1998-2001 (Northeast Recycling Council, 2001). Over half of these are in one state, Massachusetts, in response to that state's ban on computer monitor and television disposal, and most of the rest are concentrated in a few states in the East and Upper Midwest (**Table ES-3**).

Table ES-3
Residential Electronics Recycling Programs in the U.S., 1998-2001

State	Number	State	Number
Massachusetts	280	Illinois	13
Minnesota	30	North Carolina	11
California	22	Michigan	10
New Jersey	20	Iowa	3
New York	15	All Other States	81

From the perspective of attempting to replicate the most successful of these programs in Iowa, two considerations are most important: participation and cost. Unfortunately, most of these programs have (1) witnessed very low participation rates (averaging one percent of households per year), and (2) generated very high recycling costs, an average of $490 per ton of equipment collected for dropoff programs, and about $340 per ton for curbside programs.

In addition to government-organized recycling, four of the five major computer manufacturers and one nationwide retailer have initiated independent recycling programs for individual consumers (and small businesses). IBM and Hewlett-Packard have started very similar mail-in programs in which a consumer pre-pays a recycling fee and subsequently packages and ships equipment to a designated recycling firm. These programs are available nationwide. Compaq has started a similar mail-in program on a pilot basis in seven Midwestern states (including Iowa). Compaq's program differs from IBM's and Hewlett-Packard's in the significant feature that participating consumers are offered a 5-9% discount on a future purchase of Compaq equipment, even if the equipment recycled is not Compaq's. Gateway has two recycling programs: a trade-in program for Pentium and better computers (the consumer is paid a trade-in value upon purchase of a new Gateway computer), and a rebate program for older computers (the consumer is credited with $25.00/CPU recycled and/or $25.00/monitor recycled, against the purchase of new Gateway equipment). The national retailer Best Buy has started the pilot phase of what it hopes eventually to establish as a nationwide recycling program, in which consumers can return equipment for recycling at participating stores on designated "recycling weekends." In the approximately 10 events held through late 2001 (none in Iowa), Best Buy has not charged consumers to recycle items that do not contain a cathode ray tube (CRT), but has asked for payment of $10.00 per computer monitor or $15.00 per television. Sony has also started a pilot program in Minnesota only, in which consumers can return any item of Sony equipment at no charge, as long as they take the equipment to one of thirteen dropoff locations throughout the state.

CURRENT STATUS OF THE ELECTRONICS RECYCLING INDUSTRY

With the exception of a few firms, the electronics recycling industry is less than ten years old, and is still evolving rapidly. Barriers to entry are relatively low, so that many new players have entered and continue to enter the industry. But the industry is complex, competitive, and subject to rapid change in its markets, with the result that industry exits are almost as common as new entrances.

There are many CEE recycling models, which fall along a spectrum ranging from simple resale to full-service "demanufacturing" (dismantling electronic equipment to recover components and commodities). In general, the highest profit margins in the industry are derived from resale of functioning, recent vintage equipment. Equipment that cannot be re-sold is generally either dismantled to recover working components (e.g., hard disks, memory), or shredded to recover basic commodities (e.g., metals, plastics). Non-profit recyclers are a significant part of the industry. Without exception, their primary goal is to secure functioning equipment which can be redistributed (with or without refurbish and upgrade) to needy individuals or organizations.

Iowa has five in-state computer recyclers that handle substantial volumes of equipment, and a number of smaller recyclers:

- Midwest Computer Brokers (MCB) is a six year-old firm in Cedar Rapids. It provides the following services: equipment resale (with or without upgrade); dismantling for component recovery; resale of recovered components; and destructive recycling of low value equipment. MCB provides service to many Iowa corporations, as well as a number of Iowa educational and health care institutions, and has been involved in organizing several residential pilot programs.
- A-Tec Recycling in Des Moines is primarily a recycler of batteries and fluorescent lamps. A-Tec consolidates electronic equipment and re-ships the equipment to an out-of-state electronics recycler; it has no in-house recycling operations. A-Tec currently services a few dozen generators, most of them large corporations.
- The REACT (Rockwell Educational Access to Computer Technology) Center in Cedar Rapids is a nonprofit recycler organized and funded by Rockwell Collins, Inc. It takes donations of used equipment from about a dozen large corporations and a number of smaller firms in the Cedar Rapids area, and uses a volunteer work force to upgrade this equipment for redistribution to schools throughout Iowa. REACT refurbished about 2,500 computers in 2000.
- The Central Iowa Computer Users Group is an all volunteer organization that operates a donation and redistribution program called Recycle Old Computers Kindly (ROCK) in the Des Moines area. With limited financial and logistics support from John Deere & Company, this group refurbishes about 150-200 computers per month, which are distributed to schools.
- Iowa Prison Industries (IPI) handles most state government electronic surplus in the Des Moines area — about 2,000 personal computer systems in 2000. IPI refurbishes and reconfigures used PC systems and sells them at retail to buyers who have access to the state surplus property system. IPI also assures the destructive recycling of equipment that cannot be refurbished.

Additionally, three Iowa counties or waste districts (Linn County, Clinton County, and the Landfill of Northern Iowa Planning Area in Clear Lake) manage electronics collection or have run pilot programs.

Beyond this small number of public and private initiatives, there are no other meaningful recycling options for Iowa generators. Some number of local computer shops take used equipment from customers, Catholic Charities take equipment from a small number of generators, and some generators can make regular or sporadic donations to local schools, churches, and similar organizations. But none of these outlets, alone or in combination, amounts to a meaningful recycling option.

BARRIERS TO ELECTRONICS RECYCLING

In general, the barriers to electronics recycling can be grouped into four areas. In different combinations, these are what have impeded and continue to impede the expansion of electronics in all generating sectors — commercial, institutional, and residential. These barriers are:

1. **Law and Regulation:** The absence of any regulatory incentives or mandates directing surplus CEE out of the waste stream and toward recycling.
2. **Information.** The lack of information regarding the impacts of improper CEE management, and the lack of information about recycling alternatives.
3. **Collection:** The absence of infrastructure to collect equipment efficiently and cost effectively, and move it into recycling channels.
4. **Recycling Cost:** The high cost to recycle used equipment (particularly the environmentally problematical equipment such a computer monitors and televisions) in comparison to the cost of disposal.

These barriers have different levels of impact on different CEE generating sectors, as summarized in **Table ES-4**.

Table ES-4
Impact of Barriers to Computer/Electronic Equipment Recycling on Different Generating Sectors

Barrier	Impact of Barrier on Different CEE Generating Sectors			
	Large Business	**Small Business**	**Institution**	**Residential**
Law/Regulation	**Moderate - High** Arguably, U.S. law now prohibits CRT disposal from many generators. Clarification or definitive law and regulation needed to drive additional CEE to recycling.	**High** No legal or regulatory incentive to recycle, nor any impediment to disposal.	**High** No legal or regulatory incentive to recycle, nor any impediment to disposal.	**High** No legal or regulatory incentive to recycle, nor any impediment to disposal.
Information	**Low - Moderate** Should not be a barrier. Large firms have an Environment, Health, &Safety (EH&S) function which should be well aware of disposal liabilities, and capable of finding and evaluating recycling alternatives.	**High** Typically lack information regarding impacts of disposal, or recycling alternatives.	**Moderate** Should not be a barrier. Most institutions have an EH&S function which should be well aware of disposal liabilities. Many could use assistance in identifying recycling alternatives.	**Moderate - High** Typically lack information regarding impacts of disposal. Almost universally lack information regarding recycling alternatives. Worst in rural areas.
Collection	**Low - Moderate** Rarely an issue. Many recyclers will pick up from major accounts, and many large firms have internal logistics capabilities.	**High** A major issue. Rarely generate volumes sufficient to attract pickup by recycler, or obtain favorable transportation rates.	**Moderate - High** A major issue Rarely generate in quantities sufficient to secure favorable transportation service or rates.	**High** A major issue. No collection infrastructure. Scattered individual generators typically imply high costs.

Table ES-4 Impact of Barriers to Computer/Electronic Equipment Recycling on Different Generating Sectors				
Barrier	**Impact of Barrier on Different CEE Generating Sectors**			
	Large Business	**Small Business**	**Institution**	**Residential**
Recycling Cost	**Moderate** Of all generators, large firms have best access to donation and low-cost recycling options (high quality equipment; attractive, high volume accounts for recyclers)	**Moderate - High** Low volume, generally low quality equipment is of little interest to recyclers, implying high recycling charges.	**Moderate - High** Low volume, generally low quality equipment is of little interest to recyclers, implying high recycling charges	**High** A major issue. Small quantities, low quality imply high recycling costs.

The absence of law or regulation driving surplus CEE out of the waste stream and toward recycling is the single most significant barrier affecting all generating sectors. Until this barrier is removed, it is unlikely that the volume or proportion of surplus CEE diverted from disposal to recycling, in Iowa or elsewhere in the U.S., will increase more than incrementally.

The absence of in-state recyclers is not as significant a barrier as it might appear. Iowa's two larger commercial recyclers, A-Tec Recycling and Midwest Computer Brokers, have substantial additional capacity. And nearby states, particularly Minnesota and Illinois, are home to a concentration of electronics recycling organizations. Although long travel lanes add cost to electronics recycling for Iowa generators, recycling capacity itself is not a meaningful barrier.

PRIORITIZING IOWA ELECTRONICS GENERATORS AND WASTE STREAMS

Table ES-5 summarizes and compares the recycling and environmental status of five different electronics waste streams from the four major generating sectors. **Table ES-5** ranks each combination of waste stream and generating sector against three variables: (1) ***Volume***: the relative contribution to the electronics waste stream; (2) ***Environment***: the relative environmental impact upon disposal (based primarily on hazardous constituents); and (3) ***Status***: the status of current recycling options available to the generator. The final entry in the table integrates this information to assign a priority to each generator/waste combination as a target of policy efforts to improve its recycling status.

Table ES-5 Comparison of CEE Disposal and Recycling Status by CEE Type and Generating Sector				
Type of Equipment	Generating Sector			
	Large Business	Small Business	Institution	Consumer
Personal Computers	Volume: High Envt: Mod Status: OK *Low Priority*	Volume: High Envt: Mod Status: Poor ***High Priority***	Volume: Mod Envt: Mod Status: OK *Low Priority*	Volume: High Envt: Mod Status: Poor ***High Priority***
Computer Monitors	Volume: High Envt: High Status: OK *Low Priority*	Volume: High Envt: High Status: Poor ***High Priority***	Volume: Mod Envt: High Status: OK *Low Priority*	Volume: High Envt: High Status: Poor ***High Priority***
Computer Peripherals	Volume: High Envt: Mod Status: OK *Low Priority*	Volume: High Envt: Mod Status: Poor *Moderate Priority*	Volume: Mod Envt: Mod Status: OK *Low Priority*	Volume: High Envt: Mod Status: Poor *Moderate Priority*
Televisions	Volume: Low Envt: High Status: OK *Low Priority*	Volume: Low Envt: High Status: Poor *Moderate Priority*	Volume: Mod Envt: High Status: Poor *Moderate Priority*	Volume: High Envt: High Status: Poor ***High Priority***
Other Consumer Electronics	Volume: Low Envt: Low Status: OK *Low Priority*	Volume: Low Envt: Low Status: Poor *Low Priority*	Volume: Low Envt: Low Status: OK *Low Priority*	Volume: High Envt: Low Status: Poor *Moderate Priority*

Two generating sectors and three waste streams stand out.

Small businesses and individual consumers are the highest priority generating sectors. Both have poor access to recycling opportunities in general, and are relatively uninformed about recycling issues and opportunities. In comparison, large businesses and most institutions generally have adequate information and financial resources to identify recycling opportunities, and to understand the environmental and financial liabilities that can be associated with improper disposal.

The three waste streams of greatest importance are (1) personal computers, (2) computer monitors, and (3) televisions. Computer monitors and TVs stand out as the most important items of electronic equipment to divert from disposal, because of their leaded glass content. Although currently insufficient to produce a hazardous waste characterization, the toxic constituents of personal computers (including rechargeable batteries, some circuit board constituents, and flame retardants) are also a disposal concern. Laptop PCs are a concern because of their rechargeable batteries and fluorescent displays (which contain mercury).

LESSONS LEARNED FROM OTHER ELECTRONICS RECYCLING INITIATIVES

As Iowa considers options to improve electronics recycling opportunities for its residents and businesses, it can benefit from the experience of other state and local electronics recycling initiatives. Among the most important pieces of information that can be gleaned from recycling experience elsewhere in the country are the following:

1. Programs must be as convenient as possible to targeted participants, in terms both of timing and location;
2. To the maximum extent possible, CEE recycling should be linked to existing recycling programs. This will simultaneously enhance participation, reduce expenditures needed for publicity and education, and generate savings in setup and management expenses.
3. Collection events should use existing recycling dropoff sites whenever possible, to encourage participation and reduce costs.
4. Greater frequency encourages greater participation, and tends to reduce costs per participant and per ton of equipment collected for recycling (especially if events are linked to an existing recycling program).
5. Fees charged to participants at the time of recycling significantly discourage participation.
6. The more a consumer has to do (packaging, shipping, transporting to a remote location, etc.), the less likely he or she is to participate in CEE recycling.

POLICY OPTIONS TO IMPROVE ELECTRONICS RECYCLING IN IOWA: OVERVIEW

Improving CEE recycling for residents and small businesses in Iowa will, almost certainly, entail policy action in three areas. It is difficult to envision the widespread development of CEE recycling opportunities if only one or two of these areas are addressed.

1. Action to mandate or encourage recycling over disposal for all or a fraction of the CEE waste stream;
2. Action to foster establishment of collection and recycling infrastructure;
3. Action to provide funding for CEE recycling.

OPTIONS TO MANDATE OR ENCOURAGE ELECTRONICS RECYCLING

It is unlikely that CEE recycling opportunities for residents and small businesses will develop without action on the part of Iowa's legislature. The economics of recycling and disposal will continue to favor landfilling of used electronic equipment in Iowa. And to the extent that the private recycling industry continues to develop, its primary beneficiaries will be large businesses and institutions. Iowa cannot expect national legislation or regulatory action to address the issue; meaningful action will have to be initiated within the State.

If Iowa chooses to pursue legal and/or regulatory action to implement CEE recycling, it can do so on one of three levels — by establishing pilot recycling programs, by promulgating legislation that encourages electronics recycling, or by promulgating legislation that mandates electronics recycling.

Establishment and Funding of Pilot Programs

The legislature could provide funding to establish and assess additional pilot programs, with the goal of documenting their costs, benefits, and impacts. Advantages of this approach are that it provides a relatively low-cost means to determine public attitudes toward electronics recycling, program costs, and effectiveness, and that it could serve as a stepping stone toward gaining public and legislative support for statewide electronics recycling. Principal disadvantages are in the fact that, with 500 programs already tried out, there is probably little to be learned from one or a few more pilot initiatives, and the fact that pilot program costs are generally much higher, and recovery volumes much lower than those experienced with a committed, long-term program.

Legislation Facilitating Electronics Recycling

The legislature could establish a legal framework that would facilitate the establishment of CEE recycling at the local level, without imposing a mandate. Possible approaches to this option would include establishment of planning and implementation grants, providing a mechanism to fully or partially reimburse the local costs of CEE recycling, or pursuing cost sharing opportunities with private third parties. Advantages of this approach are that it is non-prescriptive, it could encourage municipalities to test different recycling models, and it would allow the state and municipalities to gain experience with CEE recycling without a major financial or program commitment. Major disadvantages are that this option could be as complex to plan and administer as mandatory recycling, without corresponding results, it might allow Iowa communities to repeat expensive mistakes already made elsewhere in the U.S., and that it provides no assurance that CEE recycling will be widely implemented in Iowa.

Legislation Mandating Electronics Recycling

The legislature could require statewide recycling of specified items of CEE — presumably at least including computer monitors and televisions, and potentially including other types of equipment. Such a mandate could take one of three forms: (1) A ban on disposal of specified items of CEE; (2) A requirement that communities add CEE to the items for which recycling opportunities are available; or (3) A prescriptive mandate defining what items should be targeted for recycling, how, and by whom.

1. ***Disposal Ban:*** A disposal ban would prevent targeted items of CEE from entering the waste stream, but would not necessarily dictate how else they should be collected or managed. In practice, it is difficult to imagine that this approach could be successful unless it was coupled with financial and technical assistance to set up and manage electronics recycling at the local level. A disposal ban has advantages in that it is the least prescriptive mandatory recycling option, allowing the most latitude for market development and local innovation. Disadvantages are that a disposal ban is unlikely to eliminate the need for state funding and management, that it provides the least control over how electronics are managed, and that it is almost certain to attract resistance as an "unfunded mandate.".
2. ***Require Communities to Add Electronics As A Locally Recycled Item:*** Requiring communities to add electronics to their list of recycled commodities would provide opportunities for all residents to recycle used CEE, but might not have the desired impact of diverting significant quantities from disposal. Time and experience have proven, in Iowa and elsewhere, that making recycling possible does not make recycling effective. To the contrary, it often results in relatively high implementation and operating costs coupled with low participation and capture. This combination yields very high costs per ton of material recovered, and leads to dissatisfaction and resistance to the mandated recycling program, and frequently to further state intervention to achieve desired results. Iowa has already experienced this situation in some municipalities under existing mandates for local recycling of paper, plastics, metals, and glass.

3. ***Prescriptively Establish a Statewide CEE Recycling Framework:*** A prescriptive mandate would entail a combination of a disposal ban on targeted items of CEE with a state-organized recycling initiative. This need not imply state funding or operation of statewide CEE recycling; there are other options. It would, however, require the state to lay out the framework under which funding would be generated and recycling operations would be managed. This approach provides the greatest control over participation and capture, and the greatest likelihood that these will be relatively high. It assures statewide consistency in recycling approach (with likely cost savings), and provides the greatest opportunities to identify and bring in industry or other partners. Disadvantages are that this approach would be the most complex to implement, and that it ties the state to one funding/infrastructure model.

OPTIONS TO PROVIDE COLLECTION AND RECYCLING INFRASTRUCTURE

At least nine options are available to provide the infrastructure required to allow residents and small businesses to return used electronic equipment for recycling. These include:

1. **Curbside Collection:** Residents put electronics at curbside for collection by municipal or contractor vehicles (CEE recycling integrated with collection of other recyclables). Collected electronics consolidated at recycling facility (municipal- or contractor-operated) for subsequent shipment to recycler.
2. **Dropoff at Local Recycling Dropoff Locations:** Residents take electronics to established municipal dropoff recycling locations, where electronics are consolidated and packed for shipment to recycler.
3. **Dropoff or Curbside Collection During Local Spring Cleanup Days:** Depending on local implementation, residents set out electronics at curbside with other 'spring cleanup' items, or bring electronics to a dropoff location set up for local spring cleanup.
4. **Dropoff at Local/Regional Recycling Centers:** Residents transport electronics to one of approximately 100 publicly and privately operated recycling centers, where they are consolidated, packed, and shipped to a recycler.
5. **Dropoff at Regional Household Hazardous Waste (HHW) Collection Centers:** Residents transport electronics to one of approximately 30 sites in Iowa set up to handle HHW. Electronics are consolidated at these sites, packed, and shipped to recyclers.
6. **Dropoff at Iowa DOT Garages:** Residents transport electronics to one of up to 100 IA DOT garage locations. Electronics are consolidated at these sites, packed, and shipped to recyclers.
7. **Dropoff Using the Best Buy Return Program:** Residents transport electronics to Best Buy store locations, where they are collected and packed for shipment to recyclers.
8. **Dropoff at Other Retailer Locations:** Residents transport electronics to retailers engaged by the state to participate in electronics takeback. At retail locations, electronics are consolidated, packed, and shipped to recyclers.
9. **Consumer / Small Business Mailback Program:** Consumers package electronics for shipment to recycler. Consumers take electronics to shipping location (e.g., any UPS shipping point), or possibly call for pickup at their home or business location.

Advantages and disadvantages of these options are summarized in **Table ES-6**.

RESERVED FOR TABLE ES-6

OPTIONS TO FUND STATEWIDE ELECTRONICS RECYCLING

Funding will be required to pay for any meaningful policy designed to improve electronic equipment recycling opportunities for Iowa residents and small businesses. If the state opts, at least in the near term, to implement one or a few pilot recycling programs, the relatively small expense involved could be readily funded from regular appropriations or other state or local sources. Much more significant is how the state might fund permanent, statewide recycling for used electronics.

Table ES-7 provides an overview of nine different funding options. Including different implementation scenarios, these can be differentiated into a total of fifteen different alternatives to fund statewide electronics recycling in Iowa.

Three options entail direct state funding of electronics recycling:

1. Sales tax revenues associated with purchases of computers and other electronic equipment would be captured and diverted to fund electronics recycling.
2. A portion of currently collected landfill surcharges would be designated to fund electronics recycling.
3. The state would establish funding for electronics recycling from other state revenue sources.

Another three options would shift payment for electronics recycling to the consumer. Under different implementation scenarios, the consumer could subsequently be reimbursed for this payment, either by manufacturers, or through a deposit-refund system.

4. The consumer would pay an "advance disposal fee" (ADF) at the time equipment is purchased, and these fees would be used to pay for statewide electronics recycling. Under two possible implementation scenarios, the consumer would subsequently reimbursed for the ADF payment via a cash or merchandise rebate from manufacturers.
5. The consumer would pay a recycling fee at the time he/she recycles used equipment. Under two possible implementation scenarios, the consumer would subsequently reimbursed for the recycling fee via a cash or merchandise rebate from CEE manufacturers.
6. The consumer would pay a deposit at the time new equipment is purchased. All or a portion of this deposit would subsequently be refunded to the consumer at the time the same piece of equipment is recycled.

The final three options would shift payment directly to CEE manufacturers or retailers:

7. Iowa would set up a fund to pay for electronics recycling, and requires manufacturers selling electronic equipment in Iowa to pay into this fund.
8. Manufacturers would be required to establish, fund, and manage an electronics recycling program, with state oversight but without significant direct state involvement.
9. Manufacturers and/or retailers would be provided with tax or other indirect incentives to establish an electronics takeback program.

RESERVED FOR TABLE ES-7

CONCLUSIONS AND RECOMMENDATIONS

This report was not commissioned to recommend whether or not the State of Iowa should mandate the recycling of computers, computer monitors, or any other electronic equipment. That is a top-level policy decision for the state's legislature and Department of Natural Resources.

If the state does decide to implement statewide recycling for some or all of the electronic equipment addressed in this analysis, this report makes the following conclusions and recommendations.

Waste Streams and Generators of Highest Importance

- Personal computers (including workstations, servers, etc.), computer monitors, and televisions are the items of greatest importance to divert from the waste stream.
- Individual residents and small businesses are the waste generating sectors that should be served by publicly supported electronics recycling.

Options To Provide Collection And Recycling Infrastructure

Wuf Technologies believes that the following options match up best against the criteria that tend to promote successful and cost effective recycling of surplus electronic equipment for consumers and small businesses:

1. **Dropoff at Local Recycling Dropoff Locations.** Principal advantages: Convenience to residents; Low incremental cost to implement; Builds on existing program. Principal disadvantages: Coverage (not all municipalities have dropoff sites); Consolidation requirements (shipping is cost effective only if truckload volumes are accumulated); Uncontrolled collection (many local dropoff locations are not staffed).
2. **Dropoff or Curbside Collection During Local Spring Cleanup Days.** Principal advantages: Convenience to residents; Low incremental cost to implement; Builds on existing program; Large quantities collected in short period simplifies and reduces transportation cost. Principal disadvantages: Low frequency (discourages participation); Coverage (not all municipalities have spring cleanup or equivalent)
3. **Dropoff at Local/Regional Recycling Centers**. Principal advantages: Coverage (essentially 100% of Iowans have access); Low incremental cost to implement; Consolidation (recycling centers set up for consolidation; smaller number of locations implies more rapid collection of truckload volumes). Principal disadvantages: Complexity of implementation (securing cooperation from 100 +/- individual recycling centers, cost allocation); Inconvenience to residence (distance to collection centers, hours); Probable low participation.

Options To Fund Statewide Electronics Recycling

Wuf Technologies believes that the following options offer the greatest promise to provide a stable funding source for electronics recycling, and fairly allocate costs among the parties with an interest in the success of this effort.

One of the most significant features of these options, which they have in common, is that the ultimate payment for electronics recycling is shared between the generators of electronic waste and product manufacturers. (In the options recommended here, the manufacturer payment could be spread among providers of software, games, internet services, and other products that are manufactured for and dependent on electronic hardware, and not only on the hardware manufacturers themselves.) This approach represents a commitment toward shared financial responsibility for end-of-life management of electronic products which has been widely discussed, but which has not yet been implemented in any jurisdiction in the U.S.

1. **Advance Disposal Fee with Manufacturer Merchandise Rebate to Consumer.** Principal advantages: Consistent with current sales and use tax implementation; Collection infrastructure already in place and functioning; Inventory management allows documentation of purchases by item and manufacturer (for manufacturer match); allows payment for recycling to be spread over related items purchased (e.g., software, games), not only hardware; Working precedents for tires, batteries; Merchandise rebate may be more acceptable to manufacturers than cash match. Principal disadvantages: Will be perceived as an additional sales tax; Potentially complex administration; Legal and practical difficulties levying ADF on out-of-state vendors.
2. **Advance Disposal Fee with Manufacturer Match.** Principal advantages: Consistent with current sales and use tax implementation; Collection infrastructure already in place and functioning; Inventory management allows documentation of purchases by item and manufacturer (for manufacturer match); allows payment for recycling to be spread over related items purchased (e.g., software, games), not only hardware; Working precedents for tires, batteries. Principal disadvantages: Will be perceived as an additional sales tax; Potentially complex administration; Legal and practical difficulties levying ADF on out-of-state vendors; Probable resistance from manufacturers.
3. **Capture of Sales Tax Revenues with Manufacturer Match**. Principal advantages: Direct, uncomplicated; Not perceived as a "new" tax; Collection infrastructure already in place and functioning; Inventory management allows documentation of purchases by item and manufacturer (for manufacturer match); allows payment for recycling to be spread over related items purchased (e.g., software, games), not only hardware. Principal disadvantages: Reduces an existing general fund source; Assuring collection from out-of-state vendors; Probable resistance from manufacturers.

INTRODUCTION

Used electronic equipment is one of the fastest growing parts of the U.S. waste stream, and one of the least recycled. The U.S. EPA estimates that approximately 1.5 million tons (3 billion pounds) of computers and related items and consumer video products (primarily televisions) are discarded annually in the United States. The recycling rate estimated by EPA for this equipment is about 10%, while the estimated recycling rate for all municipal solid waste is nearly 30%, and the recycling rate for other major consumer appliances (e.g., washing machines, refrigerators, air conditioners, etc.) is approximately 70% (U.S. EPA, 1999 MSW Facts and Figures).

There are numerous environmental concerns associated with the disposal of used electronic equipment. The greatest concern is associated with the presence of lead in discarded computer monitors and television sets. A typical computer monitor or TV contains 4-8 pounds of lead, and discarded monitors and televisions are characterized as hazardous waste according to EPA standards. Other toxic constituents found in personal computers, televisions, and other business and consumer electronic products include lead and cadmium (circuit boards, batteries), bromine (flame retardants), mercury (switches, laptop and other flat panel computer displays), and polychlorinated biphenyls (PCBs; capacitors and transformers in pre-1980 televisions and some other older equipment). The plastic, glass, and metal constituents of used electronics also have an essentially unlimited lifetime in the landfill environment.

Another concern particularly related to personal computers is the waste of technology represented in their disposal. Most computers are discarded not because they have lost functionality, but because their owners purchase more powerful equipment. At the same time, large numbers of U.S. households and individuals, particularly among less affluent and minority communities, continue to have limited access to computer technology. The result is a "digital divide" between computer- and internet-literate and illiterate segments of the U.S. population. There is good reason to attempt to capture older but still functional computer equipment and redistribute it by donation or low-cost sale to disadvantaged individuals, families, and organizations.

Unfortunately, recycling electronic equipment is costly. Compared to a typical Iowa landfill tip fee of $25.00 per ton, the cost to recycle used electronic equipment can be as much as $300-$400 per ton ($0.15-$0.20 per pound), with some prices quoted in Iowa during this study as high as $600 per ton ($0.30/lb). Additional costs are imposed by long transportation distances to electronics recyclers, and freight penalties imposed by the characteristic bulk of computers, monitors, TVs, and other electronic products.

Given these issues, the subject of electronic equipment disposal and recycling has captured attention at all levels of government, and has become the subject of serious discussion and debate between government organizations and the private sector manufacturers of computers and consumer electronic equipment. Government organizations would like to foster opportunities to recycle and re-use surplus electronic equipment on as wide a scale as possible, but are put off by the high costs. Equipment manufacturers, with intense competition and low profit margins, are also unwilling to absorb the cost of recycling, and are fearful of piecemeal or prescriptive legislation, at the federal or state level, which could force them to bear the cost and potentially the logistical and administrative burden of recycling their products.

This report was commissioned by the Iowa Department of Natural Resources as a piece of the evolving and expanding dialogue related to the disposition of used electronic equipment. Its general goals are twofold: 1) To equip Iowa policy makers more effectively to understand and participate in national discussions related to the use and disposition of electronic products; and 2) To pave the way for Iowa to begin to formulate policy options to promote recycling of used electronics, either standing alone with in-state solutions, or cooperating with other states in regional or national solutions.

To achieve these goals, the study has addressed a series of related questions:

1. How many computers, televisions, and related equipment are being discarded by Iowa residents and businesses?
2. What recycling options are available for used electronic equipment in Iowa? Is the availability of recycling options different for different generators?
3. What are the barriers to electronics recycling for Iowa generators? Are they different for different generators? Which generators are best served and which are worst served by the recycling industry as it now exists?
4. What equipment and which generators should be the highest priorities as the State considers attempting to expand the availability of recycling opportunities for electronics?
5. What policy options are available to the State to address these high priority generators and their electronic equipment wastes?

In addressing these questions, the study seeks to give Iowa policy makers access to, and allow them to benefit from, the substantial body of work and discussion related to electronics recycling that has taken place nationwide — in which Iowa has been an active participant. At the same time, it seeks to adapt this discussion to the particular characteristics of Iowa's waste management and recycling infrastructure, to point the way toward effective and cost-effective recycling options that can be implemented immediately or in the near future to address the challenges of recycling used electronics in Iowa.

SECTION ONE

CURRENT GENERATION RATES AND RECYCLING PRACTICES

(Note: Throughout this report the term "CEE", standing for "Computers and Electronic Equipment", is used in places interchangeably with terms such as "electronics", "electronic equipment", and "computers and related equipment.)

1.1 Commercial Sector

1.1.1 Commercial Sector CEE Generation

Wuf used two methodologies to estimate the number of surplus computers generated annually from Iowa's commercial sector (which, according to Census Bureau definitions employed with these methodologies, includes institutions such as hospitals, colleges, and universities).

The first methodology is based on a 1997 study by the U.S. Census Bureau of the use of computers in business establishments in different sectors of the economy, combined with Iowa employment data **Table 1-1** summarizes the results. Using an industry standard estimate of five years as the working life of a personal computer system, this methodology generates an estimate of approximately 155,000 computers per year retired from Iowa's commercial sector.

Table 1-1
Number of Computers Retired by Iowa Businesses Based on U.S. Census Computer Use Data

Economic Sector	N of Employees in Iowa	Pct of Employees Using Computer	N of Employees Using Computer	N of Computers Retired at 20%/Yr
Manufacturing	259,600	47.0%	122,012	24,402
Transportation / Communication / Utilities	73,900	51.4%	37,985	7,597
Wholesale / Retail Trade	359,800	40.6%	146,079	29,216
Finance / Insurance / Real Estate	87,400	81.3%	71,056	14,211
Services	396,700	54.8%	217,392	43,478
All Other	358,500	50.5%	181,023	36,205
Total	1,535,900	50.5%	775,546	155,019

Source: U.S. Census Bureau, "Computer Use in the United States, October 1997," Washington, DC, September 1999. U.S. Census Bureau and Iowa Department of Labor Iowa labor market data.

The second methodology uses computer sales data and Iowa-specific employment data to estimate the number of computers sold to Iowa businesses (again including institutions). Under this methodology, the number of computers retired in any given year is assumed to equal the number of computers sold five years previously. Results are shown in **Table 1-2**. Using this methodology, the number of computers retired in Iowa in 2000 is estimated to be nearly 180,000, a value which is projected to grow to approximately 351,000 by 2003.

Table 1-2 N of Computers Retired by Iowa Businesses Based on Computer Sales Data			
Year Computer Retired	Year Computer Purchased	Number of Computers Purchased or Retired, U.S.[1]	Number of Computers Purchased or Retired, Iowa
2000	1995	11,468,800	179,934
2001	1996	14,336,000	224,917
2002	1997	17,920,000	281,147
2003	1998	22,400,000	351,433
2004	1999	28,000,000	439,292
2005	2000	33,600,000	527,150

Notes: [1] Sales to businesses and institutions only

Source: U.S. computer sales from Dataquest, Inc. U.S. computer sales to individual consumers from Electronic Industries Alliance. U.S. computer sales to businesses and institutions calculated by subtraction. U.S. and Iowa employment data from U.S. Census Bureau and Iowa Department of Workforce Development.

The two methodologies produce quite similar estimates of commercial (including institutional) sector computer retirements in Iowa. Given that computer use in the work environment certainly grew substantially between 1997 (the year of the Census Bureau computer use study) and 2000, estimates based on the first methodology would be higher, and so closer to the estimate provided by the second methodology, if more current computer use data were available. Based on these methodologies, we estimate that Iowa's commercial/institutional sector generated about 175,000 computers as surplus in 2000, and will generate nearly 225,000 in 2001. Although it may be affected by an apparent slowdown in the U.S. economy (reflected in lower than predicted purchases of new computers and slower turnover of older machines), the number of commercial/institutional computers retired in Iowa can be expected to double, to a value approximating 500,000/year, by the year 2005.

1.1.2 Commercial Sector CEE Management Practices

Wuf contacted over 50 Iowa firms to request information on current generation and management practices for surplus computer equipment. About 30 provided usable information (Appendix A); these firms were concentrated in the metropolitan areas of Des Moines/Ames, Cedar Rapids, Waterloo/Cedar Falls, and Davenport. In addition, Wuf has information on CEE retirement and management practices from dozens of other firms, particularly in the northeastern and southern U.S., which Wuf has contacted in other contexts.

Table 1-3 summarizes information on management of surplus computers derived from Iowa firms. Of the 30 firms reporting, a total of 16 firms (40%) donate some or all of their equipment or attempt to do so. Over half of all firms report that they dispose of all or some of their surplus CEE (9 firms), or store it because they have no better alternative (7 firms). Only two firms report third-party recycling as a means of disposing of surplus CEE. Three firms return surplus equipment to the company that leased or sold them the equipment, and three firms report that disposition is handled by their parent companies. Another six firms report that they give or sell used equipment to employees, and one reports in-house scavenging for parts as a major means of disposal. One-third of all firms reported that they use multiple means of disposing of used equipment.

Table 1-3 Means of Disposing of Surplus CEE Among Thirty Iowa Firms		
Means of Disposition	**Number**	**Percent**
Donation		
Donate	12	40%
Attempt to Donate	2	7%
"Recycle"	2	7%
Internal Disposition		
Give/Sell to Employees	6	20%
Scavenge for Parts	1	3%
Disposal or Warehouse		
Dispose	9	30%
Warehouse	7	23%
Other		
Return to Leasing Company	1	3%
Return to Firm that Sold Equipment	2	7%
Handled by Parent Company	3	10%

It is important to note that half of the firms surveyed that report donation as an outlet for surplus equipment use just two channels — the REACT Center in Cedar Rapids (4 firms) and the Recycle Old Computers Kindly (ROCK) program operated by the Central Iowa Computer Users Group in Des Moines (2 firms). Because the survey respondents were clustered in areas served by these two programs — which are the only established donation programs of any size in Iowa (see Section 2.1) — these survey results probably overstate the extent of donation as a disposition practice in Iowa and the availability of donation outlets in the state.

These results are generally consistent with data gathered elsewhere in the country. **Table 1-4** summarizes results of a similar analysis conducted by Wuf in several metropolitan areas in the southern U.S. In this sample of about 50 firms, half reported donation as a regular outlet, and another 10 percent reported that they at least attempt to donate used equipment before using another disposition outlet. Similar to Iowa results, about half of all firms dispose of all or a fraction of their surplus, or store it because they have no reliable outlet, and only about 10% use a third-party recycler.

Table 1-4 Means of Disposing of Surplus CEE Among Fifty-Three Southern U.S. Firms		
Means of Disposition	**Number**	**Percent**
Donation		
Donate	30	48%
Attempt to Donate	6	10%
"Recycle"	6	10%
Internal Disposition		
Give/Sell to Employees	18	29%
Scavenge for Parts	3	5%
Disposal or Warehouse		
Dispose	20	32%
Warehouse	10	16%
Sell or Dispose as Scrap		
On-Site Sale or Bid	7	11%
Sale/Disposal as Scrap	7	11%
Other		
Return to Leasing Company	7	11%
Return to Firm that Sold Equipment	0	0%
Handled by Parent Company	1	2%

A few broad patterns emerge from the two sets of survey data, and from other information obtained by Wuf Technologies in its interactions with companies seeking CEE recycling alternatives:

- Larger firms (particularly firms with multi-state operations) tend to manage their electronic surplus better than smaller firms. Smaller firms are much more likely to be those that report storage or disposal as their primary means of CEE disposition.
- Large firms tend to have more disposition options. This results from a combination of four factors: (1) larger firms have more staff and resources to devote to identifying sound disposition options; (2) larger firms are much more attractive accounts to CEE recyclers, who seek out and compete for their business; (3) with dedicated environmental and safety staff, larger firms are more aware of the potential liabilities associated with improper CEE disposal; and (4) larger firms, much more than small firms, are moving toward equipment leasing programs with connected takeback provisions.
- There is a definite trend toward leasing CEE, with integrated end-of-life takeback. This is particularly true among large firms (although, to date, far less than a majority). Among small firms, by contrast, the vast majority continue to own all of their computers and peripheral equipment.
- Many firms really don't have any sort of plan for disposing of surplus CEE, or reliable information about what disposition options are available.
- Donation absorbs only a small fraction of potentially available equipment.
- Absent major developments in recycling infrastructure, including a significant commitment of funds, donation is unlikely to develop into a major outlet for surplus CEE. There are many reasons, including the time and cost involved to prepare used systems for donation, hardware and software security concerns, the low cost of new hardware and software, recipients' demand for quality and uniformity in the equipment they accept, and difficulty matching donors with compatible recipients.

1.1.3 Barriers To Increased Recycling

There are several major barriers to increased CEE recycling in Iowa's commercial sector. These include:

- Absence of in-state recycling options. There are only four consequential CEE recyclers in Iowa, two for-profit and two not-for-profit (see Section 2.1). And of these, only one is attempting to expand its markets or throughput. Particularly for smaller firms (which don't have resources to find or access out-of-state recyclers), this situation implies, effectively, that no markets for used CEE exist in Iowa, unless a generator can match up one-on-one with a local repair shop or donation recipient.
- The high cost of recycling. Of Iowa's two substantial for-profit recyclers, one charges an average fee of $600.00 per ton to manage used CEE. This value is not atypical among CEE recyclers, including the out-of-state recyclers available to Iowa firms. (Iowa's second for-profit recycler typically charges much less.) With landfill tipping fees that average about $33.00/ton statewide, and no other meaningful incentives to recycle, Iowa's economic signals point anywhere but toward recycling.
- Lack of information about recycling options. This is particularly relevant among small firms, who rarely have staff dedicated to waste or environmental concerns, or resources of any type devoted to surplus property management.

1.2 Institutions

1.2.1 Institutional CEE Generation

The CEE generation estimates presented in Section 1.1 include generation from Iowas's institutional sector. We are not aware of any other organized studies that have attempted to quantify CEE generation rates from institutions.

From other work, including ongoing involvement with nearly 75 college, university, and hospital recycling programs in the Northeast, Wuf has gained substantial insight into institutional CEE generation.

- Computers have thoroughly penetrated the academic and health care environment, implying high and continuing generation rates for surplus CEE. For example, in a college setting, nearly all teaching and administrative staff have computers on their desks, the computer:student ratio approaches 1:1, there are additional clusters of computers in libraries, computer labs, and other study areas; and there is a large quantity and variety of other electronic equipment purchased and used for a wide range of academic research.
- Compared to the commercial sector, the surplus CEE stream from colleges and universities is much more diverse. Individual departments, and in many cases individual faculty members, have control over their own purchasing and retirement decisions, with the result that the CEE stream is extremely heterogeneous. Additionally, the college/university CEE stream includes a nearly endless assortment of specialty computers, test, and laboratory equipment.
- (This generalization is not applicable among health care institutions, where surplus CEE tends to be much more comparable to equipment from commercial sector generators, with the addition of laboratory and medical equipment.)
- Surplus CEE is lower in quality than equipment generated from the commercial sector. In general, institutions hold on to equipment much longer than private sector generators, typically until it has no functional value. And many institutions scavenge used equipment for parts before disposing of it.
- CEE purchase, management, and disposition is decentralized, with decisions made by individual departments and little or no coordination through a centralized Information Technology function.

1.2.2 Institutional CEE Management Practices

Wuf obtained information from seven Iowa colleges and universities and five health care facilities regarding CEE management (Appendix A). Wuf has gained additional information from the nearly 75 institutions with whom Wuf has regular contact regarding CEE recycling issues.

Among Wuf's contacts were the three main campuses of the Iowa university system (Iowa State University, University of Iowa, University of Northern Iowa). These three schools, which collectively are by an order of magnitude the largest institutional CEE generators in Iowa, have coordinated management of their electronic surplus through a program known as the Research Equipment Assistance Program (REAP). Under this program, which is managed through the University of Iowa, surplus computers and related equipment are first made available for sale back to students and the local community. Equipment that is not sold is then put up to auction, and whatever fails to sell at auction is sold to commercial buyers as scrap. Very little equipment, according to contacts at the three schools, is ultimately disposed of (although it should be pointed out that the schools have no knowledge or control over the disposition of equipment sold at auction or as commercial scrap, and it would be fair to anticipate that much of this equipment is ultimately disposed of as waste).

Other Iowa schools consistently reported that most of their surplus is heavily scavenged for internal reuse. One reported sale to students and employees as a disposal option, one reported negotiated sales to a recycler, one reported auction as a primary means of CEE disposition, and one reported some efforts at donation. All stated that some fraction of their surplus is ultimately discarded, but emphasized that by the time it is disposed of, this waste stream is genuine trash (scavenged carcases, broken equipment, etc.).

These results are somewhat at odds with Wuf's experience elsewhere in the country. In general, Wuf has found that most educational institutions have a real problem with CEE disposition. Because they tend to hold on to equipment until it has little secondary value, and because they typically have fixed, limited budgets for waste management and disposal, Wuf has found that a large number of institutions have large and frequently undocumented hoards of used CEE in closets, storerooms, and swimming pools. If given the opportunity, they are generally enthusiastic participants in organized recycling efforts, responding both to students' demands for recycling and to their own recognition of the issues associated with uncontrolled CEE disposal. Wuf has also found that educational institutions rarely donate surplus CEE to community organizations, partly because most of their surplus equipment is entirely outdated, and partly because their management of used CEE is so decentralized.

Management practices among health care institutions are somewhat different, and are in general more closely aligned with commercial sector practices. Because they operate in a highly regulated environment, health care institutions tend to have well organized environmental, health, and safety initiatives, in which surplus property management, including electronic equipment, is often included.

1.2.3 Barriers To Increased Recycling

In this sector as in the commercial sector, the absence of in-state recycling options and the lack of readily available information on CEE recycling are significant barriers to recycling. In addition, the generally low quality and value of their surplus is a barrier to many educational institutions, in that it tends to restrict available recycling options and increase recycling costs. Cost is itself a major barrier to recycling at many institutions, where fixed waste management budgets tend to drive used equipment into storerooms instead of appropriate disposition channels.

1.3 Residential Sector

1.3.1 Residential CEE Generation

There are no reliable estimates of residential generation of computers and other electronic products into the waste stream.

Two of the most widely cited studies on the subject are Carnegie Mellon University's "Disposition and End-of-Life Options for Personal Computers" (1997) and the National Safety Council's "Electronic Product Recovery and Recycling Baseline Report" (1999). **Table 1-5** summarizes estimates of personal computers becoming obsolete in the U.S. from these two sources (these estimates include sales to businesses as well as consumer sales). Over the five-year period 2000-2005, the NSC's estimates are higher than Carnegie-Mellon's by a factor of two to three — a difference accounted for by divergent assumptions regarding computer sales and the age at which computers become obsolete.

Table 1-5
Published Estimates of Personal Computers Becoming Obsolete in the United States, 2000-2005

Source of Estimate	Year					
	2000	2001	2002	2003	2004	2005
Carnegie Mellon Univ., '97	15,900,000	17,100,000	18,100,000	19,100,000	20,100,000	21,100,000
National Safety Council, '99	31,600,000	41,900,000	55,400,000	63,300,000	61,100,000	63,400,000

Wuf Technology's own estimates of PC retirements from consumers are summarized in **Table 1-6**, which uses data on U.S. sales of personal computers to individual consumers to generate estimates of the implied number becoming obsolete under different assumptions regarding PC lifetime.

Table 1-6
Wuf Technologies Estimates of U.S. Consumer PC Retirements, 2000-2005

Year of Sale or Retirement	U.S. Sales to Consumers	Number Retired Annually if Average Lifespan is ...		
		... 3 Years	... 4 Years	... 5 Years
1995	8,400,000			
1996	9,400,000			
1997	11,000,000			
1998	12,800,000			
1999	15,300,000			
2000	18,900,000	11,000,000	9,400,000	8,400,000
2001	14,100,000	12,800,000	11,000,000	9,400,000
2002		15,300,000	12,800,000	11,000,000
2003		18,900,000	15,300,000	12,800,000
2004		14,100,000	18,900,000	15,300,000
2005			14,100,000	18,900,000

Source: Electronics Industry Association "Electronic Market Data Book" and International Data Corporation published data on consumer and business PC sales.

The time to obsolescence — or more precisely, the time to disposition — is a critical factor in estimating the number of consumer PCs entering the waste stream. On one hand, the National Safety Council study reports a trend toward decreasing generation cycles and more rapid retirement and obsolescence, predicting that the lifespan to obsolescence of a personal computer will decline from about 2.8 years in 2000 to 2.0 years by 2005. On the other hand, there is much anecdotal evidence (derived from surveys and information gathered at recycling events) that consumers tend to hold on to PCs long after they have purchased a replacement — either "cascading" the machine to a second or third user in their household, or simply holding on to the machine because they don't know of an appropriate disposition outlet.

Based on its own assessment of available information and recycling experience, Wuf aligns with the latter view. That is, we infer that the time to disposition among consumers is much closer to five than to two years. Using this value, and assuming that Iowa consumer purchases of PCs are proportional to Iowa's share of U.S. population, Wuf estimates that consumer PC retirements in Iowa will increase from about 99,000 in 2001 to nearly 200,000/year in 2005 (**Table 1-7**). With an average PC system weight of approximately 50 pounds (25 pound for CPU+keyboard+mouse plus 25 pounds per monitor), these values imply total tonnages of consumer sector personal computers disposed of that increase from about 2,500 tons in 200 to nearly 5,000 tons in 2005. (We also believe that the evidence points to the existence in consumers' hands of a large stockpile of genuinely obsolete computers, plus related equipment such as printers, which will tend to surge into the waste stream as recycling options are widely introduced.)

Table 1-7
Wuf Technologies Estimates of Consumer PC Retirements in Iowa, 2000-2005

	Year					
	2000	**2001**	**2002**	**2003**	**2004**	**2005**
Number of Consumer PCs Retired[1]	88,000	99,000	116,000	135,000	161,000	199,000
Weight of Consumer PCs Retired (tons)[2]	2,200	2,475	2,900	3,375	4,025	4,975

Notes: [1] Assumes that computers are discarded after five years of use, and that N of computer purchased and discarded by Iowa consumers are proportional to Iowa's share of U.S. population.

[2] About half of total weight consists of monitors, while half consists of CPUs, keyboards, mouses, and speakers.

In addition to personal computers, the consumer CEE waste stream encompasses a large number of other consumer electronic items, including computer printers, telephones, radios, stereos, VCRs and camcorders, and similar equipment. In a statewide electronics collection pilot program in Minnesota, the total quantity (by weight) of miscellaneous consumer electronic equipment collected was roughly equal to the quantity of personal computers.

And there are televisions. No state, nor any other jurisdiction contemplating electronics recycling, can ignore televisions. Like computer monitors, the cathode ray tubes (CRTs) in television sets contain several pounds of leaded glass. In fact, because most TVs are larger than the typical 14- to 17-inch computer monitor, the average discarded TV contains much more lead than the average monitor.

And there are tens of millions of TVs, potentially hundreds of millions, poised to enter the waste stream. **Table 1-8** summarizes information on the number of televisions sold in the U.S. through the 1990s, units which can be expected to enter the waste stream in the next 10 years, particularly with the expected transition to high-definition television starting before 2005. With an average of over 35 million units per year through the 1990's, the number of TVs purchased by American consumers each year is still nearly triple the number of personal computers (despite the rapid growth in PC sales throughout the decade).

Table 1-8
U.S. Television Sales, 1991 - 1998 (Thousands of Units)

Item	Year							
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Portable and Table Color TVs	17,951	19,717	21,800	24,715	23,231	22,384	21,293	21,975
Stereo Color TVs	7,377	8,534	9,767	10,438	10,579	11,189	11,096	15,647
TV/VCR Combinations	662	936	1,639	2,017	2,205	2,199	2,311	3,147
Total	25,990	29,187	33,206	37,170	36,015	35,772	34,700	40,769

Source: Electronic Industries Alliance, 1999 Electronic Market Data Book

Data from electronics collection events confirms this information. In Minnesota's statewide pilot electronics recycling program, TVs returned for recycling outweighed PCs by a factor of five (390 tons of TVs compared to 70 tons of computers), and TVs accounted for over two-thirds by weight of *all* electronic equipment recycled.

Also revealing is the age distribution of televisions collected in the Minnesota pilot. Of over 7,200 TVs collected, nearly half (47%) were older than 20 years, dating from the 1960s (10%) and 1970s (37%). Another 47% dated from the 1980s, and only 6% were manufactured in the 1990s. The average weight of a television collected in the Minnesota pilot was about 90 pounds. These data — which are confirmed by information gathered from other local recycling initiatives, and from the consumer electronics industry's own information on television purchase and use habits in the U.S — point to several facts that are important to planning for residential electronics recycling at the state or local level: (1) televisions, much more than most other consumer electronics items, tend to be "cascaded" from one user to another in a household, with the result that they are quite old when finally retired from use; (2) nonfunctional TVs tend to be stored by consumers rather than discarded; (3) because of their much older average age, televisions can be expected to be a disproportionately large source of toxic constituents when they are discarded along with PCs and other consumer electronics (for example, the Minnesota study points out that many or most 1970s- and 1980s-vintage TVs may contain PCB capacitors, which would not be found in consumer electronics items manufactured more recently).

The implications for consumer electronics recycling are harsh:

- TVs can't be ignored. They are by a wide margin the consumer electronics item for which recycling options are most in demand.
- Any consumer electronics recycling program can expect to be deluged with televisions, particularly in its early stages, as consumers disgorge obsolete equipment that they have stockpiled for years or decades;
- Because of their bulk and toxic constituents, and the fact that they are unlike the more homogeneous waste stream of recent-vintage equipment handled by most electronics recyclers, used televisions will be quite expensive to demanufacture and recycle.

This situation will be aggravated in coming years as the TV industry and consumers convert fairly rapidly to high-definition television. This transition, expected to begin by about 2003, will result in the much more rapid retirement of newer vintage (1980s and 1990s) TVs, generating a long-lasting surge of televisions into the recycling stream.

1.3.2 Assessment of Residential Electronics Collection and Recycling Efforts

The Northeast Recycling Council (NERC) recently completed a detailed analysis of residential electronics recycling initiatives nationwide. NERC identified and solicited information from nearly 500 collection programs that have been held during the past three years, and received survey responses from over forty percent of these. Complete results of this study can be found in NERC's "Setting Up and Operating Electronics Recycling/Reuse Programs: A Manual for Municipalities and Counties" (Brattleboro, VT, October 2001).

NERC identified a total of 486 residential programs in 29 states **(Table 1-9)**. Over half of all programs are in Massachusetts, in response to the state's implementation of a ban on CRT disposal. Another quarter of all programs are concentrated in a few states in the Northeast, Upper Midwest, and West Coast, including New Jersey and New York (20 and 15 programs, respectively), Michigan, Illinois, and Minnesota (10,13, and 30 programs), and California (22). The remaining programs are generally concentrated on the East Coast.

Table 1-9
Residential Electronics Recycling Programs in the U.S., 1999-2001

State	N of Programs	State	N of Programs
Massachusetts	280	Other Northeast	26
Minnesota	30	Other Southeast	14
California	22	Other Upper Midwest	21
New Jersey	20	Other Lower Midwest	11
New York	15	Mountain	6
Illinois	13	Other Pacific	6
North Carolina	11		
Michigan	10		
Total			485

Source: Northeast Recycling Council, "Setting Up and Operating Electronics Recycling/Reuse Programs: A Manual for Municipalities and Counties" (Brattleboro, VT, October 2001)

Nearly half of all programs are "special event" collections (an average of three collection days per year), nearly half use permanent dropoff facilities (an average of 198 collection days per year), and about 8 percent are curbside pickup (typically once per week, frequently with other bulky items). About 60% of all programs are open to local businesses as well as residents; the remaining 40% are limited to residents only or residents plus municipal schools and offices.

From the perspective of attempting to replicate the most successful of these programs, two considerations are most critical: participation and cost. Universally, participation rates hover at no more than a few percent of local households per year, and one percent participation is the average value. Excluding curbside programs, the average quantity of equipment recycled is about 120 pounds per participant each time equipment is dropped off.

Almost all communities paid a professional recycling organization to handle the equipment turned in by residents and businesses. These recycling costs are summarized in Table 1-10. Nearly 35% of communities report paying less than about $0.10 per pound for recycling services, which is far below market electronic recycling charges for mixed post-consumer electronics in most of the country. Wuf is aware of a number of instances in which recyclers have offered no-cost or below-market recycling services to municipalities in pilot collection programs, and we infer that most of the communities reporting these low recycling charges are taking advantage of such rates, or of recycling costs that are subsidized by another third party. In the long term, we believe that most municipalities would face recycling costs more typical in the industry, currently $0.15 or more per pound.

Table 1-10
Electronic Equipment Recycling Charges to Communities

Recycling Charge		Percent of Recycling Programs
Dollars / Ton	**Cents / Pound**	
$0	$0.00	15%
$0 - $100	$0.01 - $0.05	12%
$101 - $200	$0.06 - $0.10	7%
$201 - $300	$0.11 - $0.15	15%
$301 - $400	$0.16 - $0.20	21%
$401 - $500	$0.21 - $0.25	14%
$501 - $600	$0.26 - $0.30	6%
$601 - $800	$0.31 $0.40	4%
$801 -$1,000	$0.41 - $0.50	3%
> $1,000	> $0.50	3%

The majority of communities do not pass these costs on to residents. Half of all programs responding to the NERC survey do not charge a fee to any users (residents or businesses). Thirty-six percent charge a fee to all users of the program, and the balance charge a fee only to a subset of program users (non-residents and/or businesses and/or government organizations). In many cases, the user fee is limited to televisions and computer monitors. When charged, user fees average about $5.00 per "item," regardless of what item is assessed the fee. It is notable that a $5.00 fee is less than the recycling cost absorbed by most communities, particularly for televisions and computer monitors.

In addition to recycling costs, communities must absorb setup and ongoing administrative costs to establish and manage residential electronics collection. In general, these costs need not be excessive. Most communities with populations less than 50,000 (only seven cities in Iowa have a population over 50,000) report setup costs of less than $3,000, with annual operating costs (including recycling fees) also less than $3,000. Setup costs were not much higher even for larger communities, although annual operating costs tend to increase with community size (presumably related to the increased tonnage collected and recycling charges incurred in larger municipalities).

The bottom line for most recycling program planners can be expressed in dollars per ton of equipment collected and recycled. For special event collections and ongoing dropoff programs, this value, averaged

across all communities, is close to $490/ton. The figure is significantly less, about $340/ton, for curbside collection programs.

Nationwide, most communities responding to the NERC survey are paying for electronics recycling through the municipal budget (**Table 1-11**); over half rely on budget funding alone, and three-fourths rely on the budget for at least a portion of program funding. The second most common funding source is user fees. Fourteen percent of communities finance their programs through user fees alone, and a total of 35% derive at least a portion of their funding from this source. State grants are the least common source of funds, used by only 20% of responding communities.

Table 1-11
Funding Sources for Ongoing Collection and Special Event Electronics Recycling

Program Type	Budget Only	User Fees Only	Grant Only	Budget + User Fees	Grant + User Fees	Budget + Grant	All Three Sources
Ongoing Collection	54%	14%	3%	12%	8%	8%	1%
Special Event	45%	13%	1%	6%	4%	10%	11%

The location of collection events or facilities is a final dimension of residential electronics recycling. Among ongoing programs, municipal waste handling and recycling facilities that are already regularly used by residents are by far the most prevalent CEE recycling locations (**Table 1-12**). For special event collections, scheduled only one to three times per year, there is much more variety in location, with non-waste-related public and private locations accounting for more than half of all collection sites.

Table 1-12
Recycling Locations for Ongoing Collection and Special Event Electronics Recycling

Program Type	Muni. Recycling Center	Muni Transfer Station	Muni Landfill	Public Works Dept	HHW Facility	Charity	Electronics Recycler	Curbside	Parking Lot or Business	Public Fairground	Other Public Property	Other
Ongoing Collection	60%	13%	7%	19%	2%	4%	1%	1%				5%
Special Event	19%		1%	26%	3%	1%	1%	10%	30%	10%	14%	4%

1.3.3 Assessment of Collection Efforts Organized by Non-Government Organizations

In addition to government-organized recycling initiatives, four of the five major computer original equipment manufacturers (IBM, Hewlett-Packard, Compaq, and Gateway), the Sony Corporation, and one nationwide retailer, Best Buy, have initiated independent recycling programs for personal computers and some related items that are available to consumers and small businesses. (The office supply chain Staples recently announced an electronics recycling program, presumably nationwide, but details were unavailable when this report was finalized.)

IBM. IBM's initiative is a pre-paid mail-in recycling program. A consumer can contact the program by phone or over the web. After paying a $29.95 fee, the consumer is mailed packaging and shipping

instructions and a pre-paid United Parcel Service mailing label to ship used equipment (which can come from any manufacturer) to IBM's contracted recycler (Envirocycle, Halstead PA). The pre-paid label can be used to ship one box up to 26" x 26" x 26" and weighing up to 69 pounds. The consumer is responsible for providing packaging, and for taking the box to a UPS shipping location. This program extends a similar, independent program already run by Envirocycle prior to IBM's involvement.

Although it was introduced with some fanfare, the program has not has been widely publicized by IBM, and no states or other government organizations, to our knowledge, have attempted to publicize or promote the program in any meaningful way. The program is difficult to find on the IBM web site. The number of PCs recycled after a year of operation apparently numbers, at most, a few thousand.

Hewlett-Packard. Hewlett-Packard operates a similar program. Over the web, a consumer can request recycling of up to 10 pieces of equipment (limited to PCs, peripherals, and related equipment; no TVs or other consumer electronics), which can come from any manufacturer. Unlike IBM's, H-P's price structure is determined by the types of equipment recycled, with charges ranging from $13.00 (hand-held devices) to $34.00 (laser printers, network equipment) per item. A personal computer system consisting of CPU and monitor would have a recycling charge of $46.00; a single CPU would cost $21.00, and a single monitor would cost $29.00. The consumer is responsible for packaging the items to be recycled. HP arranges pickup of the boxed items at the consumer's doorstep, with shipment for recycling at HP's demanufacturing facility in Roseville, CA.

By all accounts, HP's program has had little impact, with pieces of equipment recycled numbering in the hundreds to a few thousand. The program has not been well publicized. It is not highlighted, and is difficult to find, on HP's web site.

Compaq. Like IBM, Compaq has joined forces with an existing mail-back program offered by an independent recycler, in this case United Recycling Industries of Chicago. Users can pack equipment, attach a pre-paid shipping label provided by United Recycling, and drop the shipment off at any UPS shipping location. The cost is $27.99 per box, with size and weight requirements similar to those enforced in IBM's recycling program. Compaq will subsequently provide each participant with a discount of 5% to 9% on a future purchase of selected Compaq equipment, even if the equipment recycled is not Compaq's. This is not a nationwide program; it is currently offered in seven midwestern states, including Iowa. The program has not been highly publicized, although it can be found easily through the United Recycling web site.

Gateway. Gateway has established two recycling programs. For Pentium and better computers, Gateway offers a trade-in program in which a consumer will be paid for a used PC (from any manufacturer) traded in upon purchase of a new Gateway computer. The value of the trade-in is determined on a case-by-case basis by the age and quality of the machine. For older equipment, Gateway offers a rebate program which provides a Gateway customer with a $50.00 rebate ($25.00/CPU, $25.00/monitor) after they purchase a new Gateway computer and then donate or recycle an old system (from any manufacturer) and supply Gateway with valid documentation. The consumer is responsible for finding the donation outlet or recycler, transporting the equipment to the donation/recycling outlet, and paying any recycling charges. Unlike the other OEMs, Gateway has publicized its recycling program as an incentive to purchase new Gateway equipment, and the recycling program is relatively easy to locate on the Gateway web site.

Best Buy. In early 2001 Best Buy publicized the initial phase of a national electronics recycling program through Best Buy store locations. Under this program, consumers can bring virtually any computer-related or consumer electronics equipment to a specific Best Buy store on a designated weekend. Best Buy arranges recycling through a contracted third party. In the events held to date, Best Buy has accepted any item that does not contain a cathode ray tube (CRT) at no charge; if a CRT is present, Best Buy has asked consumers to pay a recycling fee that has typically been $10.00 per computer monitor and $15.00 per television. Best Buy has conducted about 10 recycling events nationwide through October 2001,

publicizing each event locally. Best Buy's future plans for the program are unclear (number and geographic distribution of events, scheduling repeat events at individual locations, etc.).

Sony has rolled out a program, available in Minnesota only, which allows consumers to recycle any Sony product at no cost. The consumer is responsible for bringing the product to one of thirteen Waste Management, Incorporated dropoff locations in central and southern Minnesota. Waste Management is the recycling partner (through its Asset Management Division), and Sony bears the recycling cost. Like the HP and IBM programs, this has not, to date, had a meaningful impact in diverting used consumer electronics from disposal. It has, however, been widely publicized in Minnesota by Sony and the MN Office of Environmental Affairs. It is not easy to find on either web site.

In sum, these programs have had no discernible impact on consumer recycling of surplus PCs, and they are unlikely to do so. The IBM and H-P programs offer no incentives for consumers to participate. To the contrary, they impose significant dollar costs, and require the consumer to take on all of the logistics tasks required to package and arrange shipment of used equipment for recycling. The Compaq and Gateway programs do offer a significant recycling incentive, in the form of rebates or discounts on completed or future purchases of their equipment. In both cases, this monetary return to the consumer is equivalent to or greater than the associated recycling costs, although the consumer must assume responsibility for logistics.

The Best Buy program also offers no consumer incentives, and by definition can have no impact beyond the drawing radius of the individual Best Buy stores where a collection event is offered. (There are, for example, only five Best Buys in Iowa.) Even in Minnesota, the Sony program will have little or no impact, affecting as it does only one brand of equipment, and requiring the consumer to transport the used equipment to one of a relatively small number of dropoff locations scattered throughout parts of the state.

SECTION TWO

ALTERNATIVES TO INCREASE ELECTRONICS RECOVERY

(Note: Throughout this report the term "CEE", standing for "Computers and Electronic Equipment", is used in places interchangeably with terms such as "electronics", "electronic equipment", and "computers and related equipment.)

2.1 Current Status of CEE Recycling

2.1.1 Overview of the Electronics Recycling Industry: U.S.

The electronics recycling industry is less than ten years old, and it is still evolving rapidly. Barriers to entry are relatively low, so that many new players have entered and continue to enter the industry. But profit margins, according to available evidence, are not huge, the industry is complex and subject to wide swings in secondary market pricing, and competition for relatively high-value, high-profit electronic surplus is strong. The result is that industry exits are almost as common as new entrances.

There are many CEE recycling models, which fall along a continuum ranging from simple brokerage to full-service "demanufacturing." In general, the highest profit margins in the industry are derived from resale of functioning equipment of recent vintage (a "recent" PC, in late 2001, would include a Pentium-266 or better processor, and a 14-inch or larger monitor). This is the equipment most sought both by brokers and by demanufacturers, nearly all of whom derive a large fraction of their revenues, and a larger proportion of their profits, from resale. A brokerage/resale market for older equipment does exist, but the majority of this equipment is ultimately sold offshore, typically to Pacific Rim countries, where prospects that it will be recycled if it is not immediately remarketable are dubious, at best.

Among reputable U.S. recyclers, equipment that cannot be resold as-is is generally either dismantled to recover working components (hard disk and CD drives, memory, power supplies, etc.), or shredded to recover basic materials (ferrous and nonferrous metal, glass, plastics). In either case, the cost to recycle used equipment is almost always greater than the revenues derived from the sale of recovered components or commodities, with the result that recyclers charge customers to recycle this stream of older used equipment.

Non-profit recyclers such as Gifts In Kind International and Iowa's REACT Center are a significant part of the CEE recycling industry. Almost without exception, these organizations seek out recent vintage PC systems which can be redistributed (with or without minor upgrade) to needy individuals or organizations. Non-profits typically refuse donation of older or non-functioning PCs and of peripherals such as printers. Individual donation recipients (local schools and churches) frequently take donations from local generators, but on balance are a minor factor in the CEE recycling industry.

This pattern of development in the computer recycling industry has a major impact on the recycling options currently available to commercial, institutional, and residential generators of surplus electronics, in Iowa and elsewhere. Specifically, it has the following implications:

- Large firms have more recycling options than small firms, institutions, or individual generators of surplus CEE. Because they tend to generate large quantities of equipment, generally of more recent vintage (and so with more value) than other generators, they are sought out by both for-profit and non-profit electronics recyclers, and there is competition among recyclers to obtain their surplus.
- Large firms get better pricing than small firms, institutions, or individual generators. This is true both because they tend to generate more valuable recent vintage equipment, and because they simply generate more equipment, which allows recyclers to realize economies in processing and administration.

- All other factors being equal, large firms tend much more frequently to take advantage of recycling opportunities. They have better developed Environmental, Health, and Safety (EH&S) functions (which make them aware of the potential liabilities associated with CEE disposal), and they have the resources to devote to CEE disposition even when this entails a cost.

In short, large firms are the only generating sector that is well served by the current electronics recycling industry. Small firms and institutions can find recycling services if they expend considerable energy to do so and are willing and able to absorb hefty recycling charges. Individual consumers are almost entirely unserved by the current population of electronics recyclers.

2.1.2 Overview of the Electronics Recycling Industry: Iowa

Three in-state recyclers handle most of the used electronics that are recycled in Iowa. Two for-profit recyclers are Midwest Computer Brokers in Cedar Rapids, and A-Tec Recycling, Inc. in Des Moines. The REACT Center in Cedar Rapids is a non-profit computer recycler managed by Rockwell Collins, Inc. Two other programs with smaller impact are a non-profit recycling operation that is managed in Des Moines by the Central Iowa Computer Users Group, and a recycling program for State of Iowa government surplus managed by Iowa Prison Industries.

Midwest Computer Brokers (MCB), Cedar Rapids (which also operates a related firm named Midwest Electronics Recycling), is a six-year-old full service electronics recycler in Cedar Rapids. It provides the following services, all of which it performs in-house: as-is resale; resale after refurbishment and component upgrade; dismantling for component recovery, with recovered parts used in-house or sold at wholesale or retail; dismantling for commodity recovery; and re-shipment of low value equipment (monitors, printers, etc.) for destructive recycling. Its highest volume, highest value customers are leasing companies, for whom it handles and disposes of off-lease equipment. It also services large and small corporate clients, as well as a number of Iowa educational and health care institutions. MCB offers one of the most favorable price/cost structures in the electronics recycling industry. Depending on the generator and volume, MCB accepts much computer equipment at no cost, and shares sales revenue for recovered or re-sold equipment and components. MCB charges a recycling fee for equipment which the company itself has to dispose of (e.g., nonfunctional monitors and printers). An MCB function from which it generates significant revenue and value for customers, and which sets it apart from most of its competitors, is its sophisticated resale capability for individual components and subassemblies. MCB expects to handle approximately 500 tons of equipment in 2002, representing a 50% increase from 2001. Contact: Dave Long, 319-845-2000.

A-Tec Recycling, Inc., Des Moines. A-Tec Recycling is primarily a recycler of batteries and fluorescent lamps. A-Tec entered the electronics recycling market as a service to existing customers in their other business areas. A-Tec consolidates the equipment it receives from generators, and re-ships the equipment to an out-of-state recycler; A-Tec does not perform any recycling operations in-house. A-Tec states that electronics recycling is not one of its business priorities, and the service is not heavily marketed. It currently services about two dozen Iowa generators, most of them large corporations. Compared to national averages, A-Tec's recycling charges are high: $0.60/lb for computer monitors, and $0.30/lb for CPUs and other computer-related equipment. Contact: Larry Young, 515-244-7357.

The REACT Center, Cedar Rapids. The REACT (Rockwell Educational Access To Computer Technology) Center takes donations of used computers from about a dozen large corporations and some number of smaller firms in the Cedar Rapids - Iowa City areas, refurbishes and upgrades the computers, loads software, and distributes the computers to schools throughout Iowa. The REACT Center relies on about 75 volunteers who perform its technical functions. It has one paid staff member. The REACT Center was organized and is funded by a non-profit foundation of Rockwell Collins, Inc., and Rockwell Collins employees and former employees make up the large majority of its volunteer work force. Its operating budget is about $75,000 per year. The REACT Center neither picks up used computers from donors, nor does it transport refurbished computers to end users; donors and recipients alike are

responsible for transportation. REACT seeks only recent-vintage, working PCs (currently P200 or better), but does not turn away lower quality equipment if it arrives at the REACT doorstep. REACT refurbished and redistributed about 2,500 PCs in 2000, and handled another 600 that could not be refurbished and were ultimately recycled. Recycling services for low quality and non-functioning PCs, as well as for non-functioning computer monitors and other equipment, have been provided to the REACT Center at no cost by Midwest Computer Brokers. This donation of services by MCB is quite important to REACT's financial viability, in that disposal costs could otherwise add about $10,000 to REACT's budget. The REACT Center is not actively seeking to expand its operations, but has experienced some growth as additional firms in its geographic area have heard of REACT's services. Its growth is limited to some extent by its reliance on volunteer labor, and by its reliance on the single Rockwell Collins funding source. Contact: Barbara Klawiter, 319-373-7043.

Central Iowa Computer Users Group, Des Moines. The Central Iowa Computer Users Group is a small, volunteer organization which operates a donation and redistribution program called Recycle Old Computers Kindly (ROCK). ROCK is managed and operated by a small group of committed volunteers, and receives limited financial and logistics support from John Deere & Company. It operates from donated space in a local school district complex, and there are no paid staff. ROCK receives and refurbishes computers from a relatively small number of corporations in the Des Moines area, and redistributes the refurbished systems to schools in Iowa and other states. ROCK volunteers refurbish 150-200 computers per month; equipment that cannot be upgraded is recycled for scrap metal recovery. ROCK cites as its most pressing needs more space, additional paid or volunteer help, and more recipients for its refurbished computers. It does little marketing, either of its services or its products. Contact: Dan Buda, 515-965-9600.

Iowa Prison Industries (IPI), Des Moines. Iowa Prison Industries operates a recycling program which is handling most state government surplus computers from the capital region. Their volume was about 2,000 systems in 2000, and should be about the same in 2001. IPI picks up equipment declared surplus by state agencies, refurbishes and reconfigures PC systems, and sells them at retail to buyers who have access to the state surplus property system (state employees, municipalities, etc.). IPI also removes components, either for resale or re-use in reconditioned systems, and recycles carcases as scrap metal. If IPI cannot derive value from equipment it takes from a state agency, it bills the agency for its disposal cost. The most common items disposed of are monitors, for which IPI charges a $15.00/unit recycling fee. IPI's recycling function employs two full time inmate-employees, and is revenue neutral. Its manager states that the program could be expanded to handle additional equipment. Contact: Shawn Preston, 515-242-6495.

In addition, three Iowa counties or waste districts manage electronics collection programs or have run pilot programs. These include dropoffs program in Linn County (Cedar Rapids), Clinton County, and the Landfill of Northern Iowa Planning Area (Clear Lake).

Beyond these organizations, there are a few much smaller recyclers active locally in Iowa. Several respondents to Wuf's survey of Iowa businesses indicated that they recycle some surplus equipment through local computer shops, and two Iowa hospitals reported that they donated used equipment to Catholic Charities. Other generators make regular or sporadic donations to local schools, churches, and similar organizations. But none of these outlets, alone or in combination, amounts to a meaningful statewide recycling option.

2.2 Summary of Barriers to Increased Recycling of CEE from All Sectors

In general,the barriers to electronics recycling can be grouped into four areas. In different combinations, these are what have impeded and continue to impede the expansion of electronics in all generating sectors — commercial, institutional, and residential. These barriers are:

1. **Law and Regulation:** The absence of any regulatory incentives or mandates directing surplus CEE out of the waste stream and toward recycling.
2. **Information.** The lack of information regarding the impacts of improper CEE management, and the lack of information about recycling alternatives.
3. **Collection:** The absence of infrastructure to collect equipment efficiently and cost effectively, and move it into recycling channels.
4. **Recycling Cost:** The high cost to recycle used equipment (particularly the environmentally problematical equipment such a computer monitors and televisions) in comparison to the cost of disposal.

These barriers have different levels of impact on different CEE generating sectors, as summarized in Table 2-1.

Table 2-1
Impact of Barriers to CEE Recycling on Different Generating Sectors

Barrier	Impact of Barrier on Different CEE Generating Sectors			
	Large Business	**Small Business**	**Institution**	**Residential**
Law/Regulation	**Moderate - High** Arguably, U.S. law now prohibits CRT disposal from many generators. Clarification or definitive law and regulation needed to drive additional CEE to recycling.	**High** No legal or regulatory incentive to recycle, nor any impediment to disposal.	**High** Arguably, U.S. law now prohibits CRT disposal from many generators. Clarification or definitive law and regulation needed to drive additional CEE to recycling.	**High** No legal or regulatory incentive to recycle, nor any impediment to disposal.
Information	**Low - Moderate** Should not be a barrier. Large firms have an EH&S function which should be well aware of disposal liabilities, and capable of finding and evaluating recycling alternatives..	**High** Typically lack information regarding impacts of disposal, or recycling alternatives.	**Moderate** Should not be a barrier. Most institutions have an EH&S function which should be well aware of disposal liabilities. Many could use assistance in identifying recycling alternatives	**Moderate - High** Typically lack information regarding impacts of disposal. Almost universally lack information regarding recycling alternatives. Worst in rural areas.
Collection	**Low - Moderate** Rarely an issue. Many recyclers will pick up from major accounts, and many large firms have internal logistics capabilities.	**High** A major issue. Rarely generate volumes sufficient to attract pickup by recycler, or obtain favorable transportation rates.	**Moderate - High** A major issue. Rarely generate in quantities sufficient to secure favorable transportation service or rates.	**High** A major issue. No collection infrastructure. Scattered individual generators typically imply high costs.

Table 2-1 Impact of Barriers to CEE Recycling on Different Generating Sectors				
Barrier	**Impact of Barrier on Different CEE Generating Sectors**			
	Large Business	**Small Business**	**Institution**	**Residential**
Recycling Cost	**Moderate** Of all generators, large firms have best access to donation and low-cost recycling options (high quality equipment; attractive, high volume accounts for recyclers)	**Moderate - High** Low volume, generally low quality equipment is of little interest to recyclers, implying high recycling charges.	**Moderate - High** Low volume, generally low quality equipment is of little interest to recyclers, implying high recycling charges	**High** A major issue. Small quantities, low quality imply high recycling costs.

The absence of law or regulation driving surplus CEE out of the waste stream and toward recycling is the single most significant barrier affecting all generating sectors. Until this barrier is removed, it is unlikely that the volume or proportion of surplus CEE diverted from disposal to recycling, in Iowa or elsewhere in the U.S., will increase more than incrementally.

Other barriers have different impacts on different generating sectors, as summarized in the following sections.

2.2.1 Commercial Sector — Large Businesses

In general, large businesses, in Iowa and nationwide, are best poised to take advantage of existing CEE recycling opportunities, and are most likely to benefit from continued development and expansion of the private for-profit and non-profit CEE recycling industry.

Law and Regulation. Hazardous waste and other laws have not been viewed as a vehicle to influence the management of electronics from large commercial generators. It is worth noting, however, that existing hazardous waste regulations may in fact prohibit large commercial generators from disposing of CRTs, and potentially of some other surplus CEE, as nonhazardous waste. Discarded CRTs are classified by the U.S. EPA as a hazardous waste upon disposal. Therefore, unless a firm qualifies by regulation as a "small quantity generator" of hazardous wastes, it is (in theory) prohibited from disposing of CRTs by landfill or incineration, and must handle them as a hazardous waste. Many large firms exceed the small quantity generator thresholds, and so are subject to this regulation. A number of states, and EPA representatives in informal discussions, have noted that this fact implies a *de facto* ban on CRT disposal from most large corporations, and some disposal facilities have begun to refuse loads including CRTs, unless they can be documented from residential or small business sources. But, to our knowledge, only one state (California) has attempted to use this regulatory leverage generally to limit CRT disposal in its landfills, or to influence large firms to turn to other disposition options.

Information. Most large businesses have access to the information required to manage CEE cost effectively and in an environmentally responsible manner. Most large businesses maintain environmental, health, and safety staff whose responsibilities should explicitly include tracking issues like CRT management (because CRTs can be classified under state and federal law as hazardous wastes), and related issues associated with use and disposal of other hazardous constituents in used electronics. Large businesses are also sought out as potential accounts by electronics recyclers, so that information on recycling options should be readily available from recyclers themselves.

Collection. This should not be an issue for most large firms. As generators of relatively high volumes of surplus CEE, and typically high-volume users of transportation services in general, large firms should be able to negotiate favorable transportation services and rates. Many firms also have internal logistics

capabilities. And because they target large firms as priority accounts, electronics recyclers frequently offer favorable collection and transportation options as part of an electronics recycling package.

Recycling Cost. Once again, because of the high volumes and typically recent vintage of their surplus, large firms are best poised to negotiate favorable prices with recyclers and have best access to no-cost donation options. Many large firms also support an organized surplus property management function, whose explicit role is to identify and negotiate favorable disposition alternatives for surplus property, including CEE. Finally, large firms are more apt than smaller firms or institutions to be offered and to make use of CEE leasing options, which roll the cost and logistics of CEE recycling into a comprehensive lease package.

2.2.2 Commercial Sector — Small Businesses

Law and Regulation. As noted above, no current law or regulation restricts disposal as nonhazardous waste of surplus CEE from small businesses, or encourages its recycling.

Information. According to survey results from Iowa and elsewhere, most small businesses have little information regarding the regulatory status of surplus CEE or recycling options. They are typically aware that landfilling of used CEE is somehow "bad," but have little precise information on why this is so, whether there are any laws or regulations affecting their disposal of used CEE, or what other disposition alternatives might be available.

Collection. Because they generate relatively small quantities of surplus CEE, and because most of them are infrequent users of trucking or other logistics services, small businesses are at multiple disadvantages in terms of finding simple or cost-effective collection and/or transportation options for surplus electronics. They rarely generate enough surplus to take advantage of collection options that might be offered by electronics recyclers to larger corporate generators.

Recycling Cost. For similar reasons — low generation rates and generally low quality surplus — small businesses, in general, face high recycling costs. There are exceptions. For example, small businesses in fields such as law, engineering, and architecture generate high quality, high value equipment that is sought after by for- and non-profit recyclers, and some number of small businesses are keyed into local social networks that represent donation outlets for surplus equipment.

2.2.3 Institutions

Institutions, in general, share characteristics with both small and large businesses. On the one hand, most are regulated in their generation and management of hazardous wastes, and most have sufficient information at least to know that disposal of surplus CEE is environmentally and (potentially) legally problematical. On the other hand, they share with small businesses the fact that they face high collection and recycling costs.

Law and Regulation. Depending on their size, some institutions (hospitals, larger colleges and universities) may produce enough hazardous wastes to be classified as "large quantity generators," and so should be subject to a conjectural prohibition on CRT disposal (see Section 2.2.1). Smaller institutions face no current law or regulation that restricts disposal as nonhazardous waste of surplus CEE, or encourages its recycling.

Information. All but the smallest institutions handle hazardous materials and generate enough hazardous wastes that they are, or should be, aware of the environmental impacts of CRT and CEE disposal, and of the potentially associated liabilities. Most institutions have in-house EH&S staff whose responsibility it is to track and manage such issues. However, very few institutions, in Wuf's experience, have information regarding potential CEE recycling options, or internal resources sufficient to identify and negotiate favorable transportation and recycling agreements.

Collection. Because they generate relatively small quantities of surplus CEE, and because most of them are infrequent users of trucking or other logistics services, most institutions are at multiple disadvantages in terms of finding simple or cost-effective collection and/or transportation options for surplus electronics. They rarely generate enough surplus to take advantage of collection options that might be offered by electronics recyclers to large corporate generators.

Recycling Cost. Because of their relatively low generation rates and generally low-quality surplus (extensive internal "cascade", frequent scavenging of used equipment for parts), most institutions face high costs if they choose to recycle instead of dispose of their surplus.

2.2.4 Residential Sector

Collectively, all available evidence indicates that consumers are ready and willing to recycle their used computers, televisions, and other consumer electronic equipment. Unfortunately, major hurdles exist on all fronts. To date, they have presented an insuperable barrier to successful collection and recycling of residential surplus CEE.

Law and Regulation. No current law or regulation restricts disposal as nonhazardous waste of surplus CEE generated by consumers, or encourages its recycling.

Information. Other than an occasional news story discussing the technological or environmental waste associated with CEE disposal, most consumers have no source of information regarding proper (or improper) management of used CEE, or of options to disposal. Even where CEE collection initiatives have been set up, the difficulty in providing consumers with relevant information has been one of the major reasons that participation rates and total quantities collected have remained low.

Collection. The high cost and difficult logistics of collecting used CEE from individual residents have been and remain one of the most problematical issues in promoting CEE recycling from this sector.

Recycling Cost. Recycling costs for residential CEE are high. Compared to all other sectors, residential CEE is the oldest, the most diverse, and the most difficult and expensive to recycle. As noted in Section 1.3, televisions are a particularly large, difficult, and expensive material stream.

2.3 Assessment of Laws, Regulations, Policies from Other States

Table 2-2 summarizes laws, regulations, and policies affecting used electronics from the sixteen states which have taken concrete action in this area. Half of these states are in the Northeast; the rest are well scattered throughout the country.

Common to all of these states is that cathode ray tubes (CRTs) from computer monitors and television sets are the items that have been singled out for regulation. As noted in Section 3.1, CRTs consistently fail the U.S. EPA Toxicity Characteristic Leaching Procedure (TCLP), and are therefore classified under federal and state regulation as a hazardous waste when discarded. Most other electronic equipment has not been shown to consistently fail the TCLP (despite the fact that most electronics contain some quantities of hazardous constituents), and are not specifically regulated by the states that have taken action affecting used electronics.

Common to all states that have addressed CRTs is that CRTs that are capable of being reused, or that can be evaluated for reuse, are not considered a waste. Only when a CRT has been determined to be unusable is it classified as a waste to be regulated. This definition is consistent with federal regulation for all hazardous wastes under the Resource Conservation and Recovery Act.

Table 2-2
Electronic Equipment Recycling Law, Regulation, and Policy from Other States

State	Law / Regulation / Policy	Statewide Collection Program
Arkansas	2001 legislation 1) requires all state agencies to implement policies to recycle surplus electronic equipment; 2) creates a recycling fund to promote market research and provide grants to determine cost effective means to recycle scrap electronics; 3) allows state Dep't of Environmental Quality to consider a ban on electronics disposal after 1/1/2005.	None
California	Defines CRTs that are not capable of being re-used as hazardous waste, and specifically bans their disposal as solid waste. Household generated CRTs are NOT exempt. Allows used CRTs to be managed as universal waste regulations specific for electronic equipment.	None
Colorado	Specifically bans color TVs and CRTs from all sources from disposal (under the assumption that they fail TCLP[1] and are hazardous). Allows handling and recycling of CRTs under state universal waste regulations specific for electronic equipment. Specifies that hazardous waste determination should be made on stream-by-stream basis for other electronic equipment, and allows universal waste handling of equipment determined to be hazardous.	None
Connecticut	Developing a universal waste rule that presumably will cover CRTs and potentially other electronic equipment. Timing of promulgation is uncertain.	Recently (3/2002) released RFP requesting proposals for statewide collection and recycling of electronics from municipalities, state agencies, and nonprofit organizations, but it is unclear whether or not funding will be allocated to support statewide recycling.
Delaware	None	Allows households to recycle a wide variety of electronics at no cost at one of four dropoff sites in the state. Allows businesses to recycle electronics at no cost at a single site. (Funded by DE Solid Waste Authority, which manages and collects tip fees at all SW disposal facilities in the state)
Florida	Extensive policy discussion but no concrete results through early 2002. 1999 legislation established directed state Dep't of Envtl Protection and Dept of Management Services to implement a pilot recycling program, and established grants for one or more county-wide demonstration projects, funded through solid waste trust fund.	None. County-wide demonstration projects funded by solid waste trust fund.

Table 2-2
Electronic Equipment Recycling Law, Regulation, and Policy from Other States

State	Law / Regulation / Policy	Statewide Collection Program
Maine	Has adopted universal waste rules specific to CRTs, applicable to all commercial generators.	None.
Massachusetts	Bans disposal of CRTs from all sources.	Has contracted with CRT recyclers to provide statewide recycling service at a single price available to all municipalities in the state (not to business generators). Has provided grants to most municipalities in the state to partially or fully fund the cost of recycling household-generated CRTs, but plans eventually to sunset this funding. Funding source is unredeemed bottle deposits.
Minnesota	None. Extensive discussion has not yielded concrete policy results. Stated goal is to adopt universal waste regulation for electronic equipment. State policy documents point out that business-generated electronics should be managed under streamlined policies allowed by MN Pollution Control Agency (equivalent to universal waste regulation).	None. Statewide pilot program carried out in 2000-2001 with input and financial assistance from multiple parties. Partial-state dropoff collection established by a single manufacturer (Sony) for its own products (see Section 1.3).
Nebraska	Guidance specifies that non-household generators of over 220 lbs/month of CRTs must manage CRTs as hazardous waste; generators of less than 220 lbs/month of CRTs can manage CRTs as solid or hazardous waste. Guidance points out that CPUs should be tested to determine hazardous waste status	None.
New Hampshire	Has adopted universal waste rules specific to CRTs, applicable to all commercial generators.	None.
New Jersey	Has determined that CRTs are hazardous and must be managed as such. Allows CRTs to be recycled through one of seven state-approved recyclers pending development of universal waste regulations.	None.
New York	Guidance points out that CRTs from commercial sources typically fail TCLP and should be treated as hazardous. CRTs from households and from commercial generators of less than 220 lbs/month (total hazardous wastes) are exempt.	None.
North Carolina	Guidance points out that color CRTs typically fail TCLP and encourages commercial generators to find recycling alternatives to avoid potential future liability.	None.
Ohio	Guidance states that used computers (including CRTs) are not considered hazardous if recycled.	None.

Table 2-2
Electronic Equipment Recycling Law, Regulation, and Policy from Other States

State	Law / Regulation / Policy	Statewide Collection Program
Rhode Island	None.	Residential generators (only) can recycle electronics at a single dropoff location. Collections are 1x per month. Funded by MSW tipping fees collected by the RI Resource Recovery Corporation, which manages and collects all tipping fees in Rhode Island at the one permitted landfill in the state.

Notes: [1] TCLP = "Toxicity Characteristic Leaching Procedure", used by U.S. EPA to determine whether or not a waste is hazardous.

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The most common regulatory approach toward used CRTs that cannot be re-used is classification as a "universal waste." This is the approach that has been taken by California, Colorado, Maine, Massachusetts, and New Hampshire, and is under development in Connecticut, Minnesota, and New Jersey. Universal wastes are a regulatory class established by the U.S. EPA to encompass wastes which are classified as hazardous, but which are not acutely toxic and are generated in large quantities by a very large number of generators, making them cumbersome and costly to manage under EPA's core hazardous waste regulations. (Other universal wastes include, for example, mercury-containing batteries and fluorescent lamps). EPA has established a framework which allows states to develop specific regulations for each type of universal waste, less stringent than full hazardous waste regulation, and intended to promote recycling. Consistent among the state CRT regulations that have been adopted to date is their establishment of common sense handling, transportation, disposition, and record-keeping requirements, and their promotion of recycling as the least regulated option for the ultimate management of CRTs and their constituents.

The three states that have taken the most aggressive stance under the universal waste framework are California, Colorado, and Massachusetts. Either by direct legislation (Massachusetts), or a strict interpretation of hazardous waste rules (California, Colorado), these states have banned the disposal of CRTs from *all* sources, including individual households. The other states that have adopted the universal waste approach have exempted household-generated CRTs from regulation, and in some cases have also exempted CRTs from "conditionally exempt small quantity generators" (CESQGs) – that is, generators who produce less than 220 pounds of hazardous waste (including CRTs plus other materials) per month. In these states, CRTs from households and CESQGs can still be discarded in landfills and incinerators as a solid waste.

Several states (e.g., Florida, Nebraska, New York, North Carolina) that have not specifically adopted regulations covering CRTs have published guidance that points out that these items are in fact classifiable as hazardous waste and should be managed as such. But it is clear that none of these states is attempting meaningful enforcement against generators – large or small – who manage CRTs as solid waste. These states (along with several others not cited in Table 2-2) encourage generators to manage CRTs and other electronics for recycling, but no regulatory teeth are to be found behind their printed encouragement.

The two (geographically) smallest states in the U.S., Rhode Island and Delaware, have not taken the step of prohibiting or regulating disposal of used electronics, but have implemented statewide recycling programs, available at no cost either to all generators (Delaware), or to all household generators (Rhode Island) of used electronics. It is unlikely, however, that this very progressive model could be replicated outside of these two states, where the maximum driving time from any point to a central dropoff location is less than an hour.

In many more states, there has been discussion of additional regulation of CRTs and potentially of other electronics, but no additional legislation has been adopted, and no other meaningful actions have been taken.

Many states appear to be waiting for serious guidance from the U.S. EPA, which has been no more definitive in its approach toward used electronics than the most wishy-washy of the states. EPA's public stance is that most CRTs fail the TCLP, are therefore classifiable as hazardous waste, and should be treated as such. But EPA has not taken any enforcement action toward generators of used CRTs who do not manage them as hazardous wastes, and has not attempted to influence individual states to enforce RCRA's hazardous waste requirements regarding the proper (i.e., hazardous waste) management of used CRTs. EPA is itself developing a universal waste regulatory approach toward CRTs, and possibly toward other electronic equipment. Originally scheduled for proposal in early 2001, this regulation has been delayed, and no proposal date is currently promised (the most recently promised date was late 2001). In

the interim, EPA has encouraged individual states to develop and adopt universal waste regulations for CRTs, with the tacit assurance that such an approach would be consistent with the regulations ultimately put forth by EPA.

In addition to Delaware and Rhode Island, only Massachusetts has attempted to establish a statewide infrastructure for electronics collection, which it has done by providing grants to a large number of municipalities (funded largely from unclaimed bottle bill deposits), and establishing statewide master recycling contracts available to all municipalities. Several other states have sponsored pilot recycling programs (in addition to those listed in Table 2-2, many of the collection programs described in Section 1.3 have been state-subsidized), and Connecticut recently published a Request for Proposals seeking recommendations for the establishment of statewide collection. It is unclear that this RFP will result in actual infrastructure establishment, however, or that funds will be allocated in Connecticut to support statewide electronics collection and/or recycling.

SECTION THREE

POLICY OPTIONS TO INCREASE ELECTRONICS RECYCLING

3.1 Comparative Assessment of Electronics Waste by Equipment Type And Generating Sector

Table 3-1 summarizes and compares the recycling and environmental status of six different electronics waste streams from the four major generating sectors. Table 3-1 ranks each combination of waste stream and generating sector against three variables: (1) ***Volume***: the relative contribution to the electronics waste stream; (2) ***Environment***: the relative environmental impact upon disposal (based primarily on hazardous constituents); and (3) ***Status***: the status of current recycling options available to the generator. The entry in the table integrates this information to assign a priority to each generator/waste combination as a target of policy efforts to improve its recycling status.

Table 3-1
Comparison of CEE Disposal and Recycling Status by CEE Type and Generating Sector

Type of Equipment	Generating Sector			
	Large Business	**Small Business**	**Institution**	**Consumer**
Personal Computers	Volume: High Envt: Mod Status: OK *Low Priority*	Volume: High Envt: Mod Status: Poor ***High Priority***	Volume: Mod Envt: Mod Status: OK *Low Priority*	Volume: High Envt: Mod Status: Poor ***High Priority***
Computer Monitors	Volume: High Envt: High Status: OK *Low Priority*	Volume: High Envt: High Status: Poor ***High Priority***	Volume: Mod Envt: High Status: OK *Low Priority*	Volume: High Envt: High Status: Poor ***High Priority***
Computer Peripherals	Volume: High Envt: Mod Status: OK *Low Priority*	Volume: High Envt: Mod Status: Poor *Moderate Priority*	Volume: Mod Envt: Mod Status: OK *Low Priority*	Volume: High Envt: Mod Status: Poor *Moderate Priority*
Laboratory/Medical Equipment	Volume: Low Envt: Mixed Status: OK *Low Priority*	Volume: Low Envt: Mixed Status: Poor *Moderate Priority*	Volume: Mod Envt: Mixed Status: OK *Low Priority*	Volume: Low Envt: Mixed Status: Poor *Low Priority*
Televisions	Volume: Low Envt: High Status: OK *Low Priority*	Volume: Low Envt: High Status: Poor *Moderate Priority*	Volume: Mod Envt: High Status: Poor *Moderate Priority*	Volume: High Envt: High Status: Poor ***High Priority***
Other Consumer Electronics	Volume: Low Envt: Low Status: OK *Low Priority*	Volume: Low Envt: Low Status: Poor *Low Priority*	Volume: Low Envt: Low Status: OK *Low Priority*	Volume: High Envt: Low Status: Poor *Moderate Priority*

Two generating sectors and three waste streams stand out.

Small businesses and individual consumers are clearly the highest priority generating sectors. Both have poor access to recycling opportunities in general, and are relatively uninformed about recycling issues and opportunities. In comparison, large businesses and most institutions generally have adequate information and financial resources to identify recycling opportunities, and to understand the environmental and financial liabilities that can be associated with improper disposal.

The three waste streams of greatest importance are (1) personal computers, (2) computer monitors, and (3) televisions. Monitors and TVs stand out as the most important items of electronic equipment to divert from disposal, because of their leaded glass content. Although lead has not been clearly demonstrated to leach from broken or unbroken monitors in a landfill environment, monitors generally fail the U.S. EPA's toxicity test for hazardous waste, and should be treated as such. Although insufficient under current regulations to produce a hazardous waste characterization, the toxic constituents of personal computers (including rechargeable batteries, some circuit board constituents, and flame retardants) are also a disposal concern. Laptop PCs are a concern because of their rechargeable batteries and fluorescent displays (which contain mercury). Rechargeable nickel-cadmium batteries are the largest source of cadmium in municipal solid waste, and nationally electronics are a leading source of mercury in solid waste.

We judge other electronics waste streams to be of comparatively less importance. Computer peripherals are generated in relatively high volumes from all sectors, but the environmental impacts associated with their disposal are lower, as is their residual technology value. Laboratory and medical equipment is generated primarily from the institutional sector and from some businesses. Most of these generators, however, have access to recycling options, and should have adequate knowledge and resources to take advantage of them.

The large category of "other" consumer electronics — or at least portions of this waste stream — may merit policy consideration. The primary concern would be items that contain rechargeable batteries, including items such as cellular phones, camcorders, and other portable electronic equipment.

3.2 Status and Direction of Private Sector Recycling Efforts

Table 3-2 summarizes the current status and direction of the private recycling industry as it interacts with the major generating sectors and their electronics waste streams. Small businesses and individual consumers again stand out as the sectors that are currently underserved by active CEE recyclers; this situation is unlikely to change in the foreseeable future. Large businesses have access to private recyclers for essentially all of their electronics waste stream. Institutions can find private recycling outlets for most of their wastes, with the notable exception of televisions, of which institutions in general are significant generators.

Among waste streams, PCs, computer peripherals, and laboratory equipment are the waste streams now most widely handled by private recyclers. Given that recyclers are now tapping only a small fraction of the potentially available tonnage of these items, future developments in the industry are likely to encompass wider targeting of these wastes, rather than expansion into new material types. This trend will leave high volume waste streams including televisions and other consumer electronic equipment still unserved or underserved by private recyclers.

Table 3-2 Status and Future Direction of Private Recycling Efforts, by CEE Type and Generating Sector				
Type of Equipment	**Generating Sector**			
	Large Business	**Small Business**	**Institution**	**Consumer**
Personal Computers	Status: OK Direction: OK	Status: Poor, $ Direction: Poor	Status: OK, $ Direction: OK, $	Status: Poor, $ Direction: Poor, $
Computer Monitors	Status: OK Direction: OK	Status: Poor, $ Direction: Poor, $	Status: OK, $ Direction: OK, $	Status: Poor, $ Direction: Poor, $
Computer Peripherals	Status: OK Direction: OK	Status: Poor, $ Direction: Poor, $	Status: OK, $ Direction: OK, $	Status: Poor, $ Direction: Poor, $
Laboratory/Medical Equipment	Status: OK Direction: OK	Status: N/A Direction: N/A	Status: OK Direction: OK	Status: N/A Direction: N/A
Televisions	Status: N/A Direction: N/A	Status: N/A Direction: N/A	Status: Poor, $ Direction: Poor, $	Status: Poor, $ Direction: Poor, $
Other Consumer Electronics	Status: OK Direction: OK	Status: N/A Direction: N/A	Status: N/A Direction: N/A	Status: Poor, $ Direction: Poor, $
Abbreviations: Direction = Wuf Technologies assessment of the likely direction of future private sector recycling opportunities $ = Recycling is expensive compared to prices available to high-volume generators N/A = Not applicable				

3.3 Review of CEE Recycling Initiatives Attempted in Iowa and Elsewhere

This section focuses on recycling initiatives targeted at consumer and small business electronics waste streams, identified in Section 3.1 as the highest priorities for possible policy intervention, and in Section 3.2 as the sectors most likely to remain underserved by private sector recyclers.

The unifying characteristic of all recycling initiatives so far targeted at these generators is their inefficiency — both in economic terms and in terms of participation rates and quantities of electronics recovered. As discussed in Section 1.3.2, participation in the approximately 500 residential electronics recycling programs so far initiated in the U.S. has averaged about 1% of eligible households. The cost of these programs has been very high, averaging about $500.00 per ton of equipment recycled in dropoff recycling initiatives, and about $350.00 per ton of equipment recycled in curbside programs.

Some of the lessons learned from these initiatives (most of them common sense to recyclers) include the following:

1. Programs must be as convenient as possible to targeted participants, in terms both of timing and location;
2. To the maximum extent possible, CEE recycling should be linked to existing recycling programs. This will simultaneously enhance participation, reduce expenditures needed for publicity and education, and generate savings in setup and management expenses.
3. Collection events should use existing recycling dropoff sites whenever possible, to encourage participation and reduce costs.
4. Greater frequency encourages greater participation, and tends to reduce costs per participant and per ton of equipment collected for recycling (especially if events are linked to an existing recycling program).

5. Fees charged to participants at the time equipment is recycled significantly discourage participation.
6. The more a consumer has to do (packaging, shipping, etc.), the less likely he or she is to participate in CEE recycling.

These lessons define the framework of the most efficient possible collection program for consumer and small business electronics. If the program is a dropoff initiative, it should have the following characteristics, which will tend both to enhance participation and the quantity of equipment collected, and to reduce total and per-ton costs:

- It should be established at a dropoff location where consumers (including small business owners) already take recyclables.
- It should be as frequent as possible, preferably 100% congruent with already scheduled recycling dropoff hours.
- There should be no packaging requirements; participants should be able to drop off equipment as they've stored it in their homes or businesses.
- There should be no fee imposed when equipment is recycled. Program funding should come from other sources.

If the program is a curbside initiative (presumably in communities already served by curbside recycling), it should have the following characteristics:

- To the maximum extent possible, CEE collection should take place on already scheduled curbside recycling days.
- To the maximum extent possible, CEE collection should make use of existing vehicles, and already scheduled staff time.
- Packaging or bundling requirements should be minimal, balancing the goal of promoting participation against the time and cost entailed when recycling staff are required to handle loosely packaged or unpackaged items.

These planning and implementation features will tend to maximize participation and minimize the cost of collecting used equipment for recycling. Controlling transportation and recycling costs is the second area where residential and small business recycling initiatives have proven inefficient. A number of steps can be taken to minimize these costs:

- Establish collection sites and schedules to allow truckload shipments, which will provide significant savings in transportation, and generate additional savings in recycling costs.
- Find and engage a low cost recycler. Private sector recyclers vary widely in the costs they charge to handle used electronics. Time and effort spent to identify a low-cost recycler is generally more than compensated in recycling cost savings.
- Find and take advantage of opportunities to use low cost labor in collection, recycling, or both. This could include, for example, inmate labor, or labor provided by sheltered workshops (e.g., Goodwill).
- Find and use partners to share recycling costs. Some potential partners are already active in CEE recycling — for example, the Rechargeable Battery Recycling Corporation (which was established by the electronics and battery industries to recycle of nickel-cadmium and other rechargeable batteries). Others might include retailers such as Best Buy, OEMs like Compaq, IBM, and H-P, electronics recyclers, or non-profit organizations.

3.4 Current Iowa Laws and Policies that Hinder or Promote CEE Recycling

Iowa law and regulation are neutral — for all intents and purposes, silent — on the subject of electronics recycling. By their silence, they tacitly endorse disposal over recycling, because they contain no restrictions on disposal of CEE, and landfill tipping fees in the state are low enough that disposal is the lower cost alternative. Nor does Iowa law provide leeway which would allow the Department of Natural Resources to regulate CEE management and in the absence of legislative action.

Iowa does have two legal structures that could be used to provide financial support for recycling, and have been so used in other states. Iowa's bottle deposit law generates funds in the form of unredeemed deposits which could potentially be used to support recycling-related initiatives, including CEE recycling. A precedent exists in Massachusetts, where unredeemed bottle deposits, totaling millions of dollars a year, are a major source of funding for CEE recycling and other recycling initiatives. Under current Iowa law, however, unredeemed deposits remain in the private distribution network. It is unclear, at best, whether legislative support could be developed to pull these funds back into state government, much less to assure their diversion to recycling-related uses.

Another funding mechanism which could be used to support CEE recycling is Iowa's landfill surcharge, which currently generates roughly $9.5 million per year which is divided between the state and local solid waste agencies. This fund is fully committed, however, partly to state needs and partly to municipalities and waste planning districts. Again, it appears at best dubious that the will exists to shift these funds to an enterprise like CEE recycling.

(A bill under discussion in the legislature's 2002 session would require the Department of Natural Resources to develop rules regarding the proper disposition of electronics, particularly those containing toxic constituents.)

3.5 Policy Options to Improve CEE Recycling in Iowa

Improving CEE recycling for residents and small businesses in Iowa will, almost certainly, entail policy action in three areas. It is difficult to envision the widespread development of CEE recycling opportunities if only one or two of these areas are addressed.

1. Action to mandate or encourage recycling over disposal for all or a fraction of the CEE waste stream;
2. Action to foster establishment of collection and recycling infrastructure;
3. Action to provide funding for CEE recycling.

3.5.1 Options to Mandate or Encourage CEE Recycling

It is unlikely that CEE recycling opportunities for residents and small businesses will develop without action on the part of Iowa's legislature. As discussed above (see Section 2.2), the economics of recycling and disposal will continue to favor landfilling of used electronic equipment in Iowa. And to the extent that the private recycling industry continues to develop, its primary beneficiaries will be large businesses and institutions.

Nor can Iowa expect national legislation or regulatory action to force the issue. Solid waste in general has been a back-burner issue in the U.S. Congress for a number of years, and there is no evidence that this situation will change. The September 11 incidents and the onset of a nationwide recession have pushed solid waste even further into Washington's legislative and regulatory shadows.

If Iowa chooses to pursue legal and/or regulatory action to implement CEE recycling, it can do so on one of three levels:

1. Establishment and Funding of Pilot Programs
2. Legislation Facilitating Electronics Recycling
3. Legislation Mandating Electronics Recycling

3.5.1.1 Establishment and Funding of Pilot Programs

The legislature could provide funding to establish and assess additional pilot collection and recycling programs.

Advantages of this Approach:

- A low-cost approach to determine public receptiveness to electronics recycling;
- A low-cost approach to determine the costs of program setup and management, types and volumes of CEE recovered, and recycling costs;
- Potentially allows comparative evaluation of alternative recycling models (if more than one pilot model is implemented);
- Could build support for a subsequent statewide initiative;
- More likely to gain legislative support than an immediate leap to a full-scale, statewide program;
- Could encourage private sector emulation, limiting the extent of further state action required;
- Allows Iowa to await and observe further developments in the private sector, other states, and the federal government; keeps Iowa from getting too far ahead of the curve in electronics recycling;
- There are no examples of successful statewide, full-scale programs. Implementing a pilot gives Iowa the advantage not only of gaining some in-state recycling experience, but of taking advantage of further developments and experience in other states.
- Pilot programs tend to generate little resistance, and often garner cooperation from partners such as electronics firms, major retailers, etc.
- A successful pilot could facilitate subsequent establishment and implementation of a statewide program.

Disadvantages of this Approach

- With nearly 500 recycling permanent and pilot programs now operating or completed nationwide, there is little to be learned from another pilot;
- Pilot costs and recovery volumes rarely reflect those experienced with committed long-term implementation. Implementation of a pilot would likely provide distorted information regarding costs and impacts of a subsequent full-scale program.
- The economic and environmental impacts of CEE disposition are current, substantial, and growing. A pilot program simply puts off the time they will have to be fully addressed, and they will be larger when this “day of reckoning” ultimately arrives.

- Implementation of a pilot only pushes off the time when the state will have to face the challenges of implementing a statewide program, and the issues that will be associated with such a program. Little is likely to be learned during a pilot that will help address or alleviate these later challenges.

3.5.1.2 Legislation Facilitating Electronics Recycling

The legislature could establish a legal framework that would facilitate the establishment of CEE recycling at the local level, without imposing a mandate. Possible approaches to this option would include establishment of planning and implementation grants, providing a mechanism to fully or partially reimburse the local costs of CEE recycling, or pursuing cost sharing opportunities with private third parties.

Advantages of this Approach

- Could encourage municipalities to test different recycling models.
- Allows state and municipalities to gain experience with CEE recycling without a major financial or program commitment.
- Non-prescriptive.

Disadvantages of this Approach

- Could be as complex to plan and administer as mandatory recycling, without corresponding results.
- Allows Iowa communities to repeat expensive mistakes already made elsewhere in the U.S.
- No assurance of wide implementation of CEE recycling.
- No assurance that locally implemented recycling will be effective or cost-effective

3.5.1.3 Legislation Mandating Electronics Recycling

The legislature could require statewide recycling of specified items of CEE — presumably at least including computer monitors and televisions, and potentially including other types of equipment. Such a mandate could take one of three forms: (1) A ban on disposal of specified items of CEE; (2) A requirement that communities add CEE to the items for which recycling opportunities are available; or (3) A prescriptive mandate defining what items should be targeted for recycling, how, and by whom.

1. Disposal Ban

A disposal ban would prevent targeted items of CEE from entering the waste stream, but would not necessarily dictate how else they should be collected or managed. Its impact would be to force municipalities or planning districts to develop recycling alternatives, with or without additional guidance or support from the state. In practice, it is difficult to imagine that this approach could be successful, unless it was in fact coupled with substantial financial and technical assistance from the state to municipalities and/or districts to set up and manage electronics recycling.

Advantages of this Approach

- Least prescriptive; allows most freedom for markets to develop and communities to establish recycling programs.
- Does not necessarily imply state a state funding requirement.

Disadvantages of this Approach

- Defers, does not eliminate, the ultimate need for state funding and management (implementation of such a ban in Massachusetts was delayed over two years while the state worked through implementation and funding issues).
- Unless coupled to market development initiatives, does not guarantee development of markets and recycling options, which are required for the ban to be successful.
- Almost certain resistance as an "unfunded mandate" on municipalities.
- State has least control over how banned electronics are managed.
- No assurance that CEE recycling will be effective or cost-effective.

2. Require Communities to Add CEE to As A Locally Recycled Item

Requiring communities to add electronics to their list of recycled commodities would provide opportunities for all residents to recycle used CEE, but might not have the desired impact of diverting significant quantities from disposal. Time and experience have proven, in Iowa and elsewhere, that making recycling possible does not make recycling effective. To the contrary, it often results in relatively high implementation and operating costs coupled with low participation and capture rates. This combination yields very high costs per ton of material recovered, and leads to open dissatisfaction and resistance to the mandated recycling program, and frequently to further state intervention to achieve desired results. Iowa has already experienced this situation in some municipalities under existing mandates for local recycling of paper, plastics, metals, and glass.

Advantages of this Approach

- Builds on existing state and local recycling infrastructure.
- Non-prescriptive; allows communities to develop recycling programs suited to local needs and conditions.
- Recovered electronics could contribute to the mandated 25% state diversion rate.

Disadvantages of this Approach

- Non-prescriptive; allows Iowa communities to repeat expensive mistakes already made elsewhere in the U.S.
- No assurance that recycling will be effective or cost-effective.
- To be effective, requires extensive outreach and education program to assist with local implementation.
- Likelihood of resistance as an "unfunded mandate."

3. Prescriptively Establish a Statewide CEE Recycling Framework

A prescriptive mandate would entail a combination of a disposal ban on targeted items of CEE with a state-organized recycling initiative. As outlined in Sections 3.5.2 and 3.5.3, this need not imply state funding or operation of statewide CEE recycling; there are other options. It would, however, require the state to lay out the framework under which funding would be generated and recycling operations would be managed.

Advantages of this Approach

- Greatest control over participation and capture, and greatest likelihood that these will be relatively high.
- Easiest means to couple funding with infrastructure.
- Allows state to take advantage of lessons learned elsewhere in establishing effective funding and infrastructure for CEE recycling.
- Ultimately, probably the easiest option to administer.
- Assures statewide consistency in recycling approach, with likely cost savings.
- Most prescriptive. Municipalities might see this as an advantage over being left on their own to plan and implement CEE recycling.
- Most room for state to ID and bring in industry or other partners.

Disadvantages of this Approach

- Ties the state to one funding/infrastructure model.
- Most complex, and so (possibly) most likely to generate resistance during planning, and most time-consuming to plan and implement.
- Most prescriptive. Could encounter resistance from municipalities on this account.

3.5.2 Options to Provide Collection Infrastructure

About 600 municipalities, with over 63 percent of Iowa's population, currently offer curbside recycling (Curbside recycling is not available to all residents of these communities, however. The total proportion of Iowa residents served by curbside recycling is about 50%.) Municipalities with curbside recycling include almost all of Iowa's major cities (Council Bluffs and Waterloo are the main exceptions). Unlike most other states, Iowa has also seen the penetration of curbside recycling to a large proportion of its much smaller communities. Curbside recycling is offered in over 550 communities with populations of less than 5,000, including more than 400 communities with populations less than 1,000. The fact that curbside recycling is offered, however, does not necessarily imply that it is effective. According to Department of Natural Resources information, some number of these communities, of all sizes, have invested minimal effort and resources in recycling, with the result that participation and recycling rates are low.

Iowa's Department of Natural Resources is also implementing a major push to influence communities to adopt "pay-as-you-throw" funding mechanisms for MSW management, which are being adopted by both curbside- and dropoff-serviced communities. About 200 communities have already adopted pay-as-you-throw, and another 200+ programs are under consideration.

Iowa's curbside communities have the option of adding electronics collection to these programs, or of implementing dropoff electronics recycling. Iowa's remaining 350 communities, which offer dropoff recycling only, do not have a current curbside option for electronics.

Wuf Technologies has identified nine options which could be employed to implement electronics recycling infrastructure in Iowa — the curbside recycling option, seven dropoff options, and a mailback option. These are summarized below and in **Table 3-3**, and are described more fully in **Appendix B**.

Table 3-3
Overview of Electronics Recycling Implementation Options

	IMPLEMENTATION OPTION								
	Curbside	**Local Dropoff Centers**	**Local Spring Cleanup Days**	**Local/Regional Recycling Centers**	**Regional HHW Collection Centers**	**Iowa DOT Garages**	**Best Buy Return Program**	**Other Retailer Return Program**	**Mail-Back Program**
DESCRIPTION	CEE set out at curbside with, or separate from, other recyclables	CEE brought by residents to local dropoff center	CEE returned to spring cleanup collection location	CEE brought by residents to local or regional dropoff center	CEE brought by residents to regional HHW collection site	CEE brought by residents to selected Iowa DOT garage sites	CEE brought by residents to Best Buy locations	CEE brought by residents to other retailer locations	CEE packed and shipped by residents to electronics recycler
FREQUENCY	Set by municipality (1x per week to 1x per month)	Set by municipality (corresponding to current dropoff hours)	1x -2x per year	Established by recycling center (corresponding to current dropoff hours)	Corresponding to HHW collection schedule	To be established	To be established	To be established	On demand
EVALUATION FACTORS									
User Convenience (Timing, Location)	Good	Good	Good	Fair	Fair-Poor	Poor	Poor	Poor	Poor
Linked to Existing Program	Good	Good	Good	Good	Fair	Poor	Poor	Poor	Poor
Use Existing Sites / Facilities	Good	Good	Good	Good	Fair	Fair-Poor	Poor	Poor	Not. Appl.
Frequency	Good	Good	Fair-Poor	Good	Fair-Poor	Poor	Depends on implementation	Depends on implementation	Good
Complexity to Consumer	Good	Good	Good	Fair	Fair-Poor	Fair-Poor	Fair	Fair	Poor
Statewide Coverage	Fair (to 60%)	Fair-Good	Good	Good	Fair	Fair	Poor	Poor	Good
Incremental Cost to Implement	High	Low	Low	Low	Moderate	High	High	High	Low
Complexity of Implementation	High	Low	Low	Low	Moderate	High	High	High	High

1. Curbside Collection

Description: Residents put electronics at curbside for collection by municipal or contractor vehicles (CEE recycling integrated with collection of other recyclables). Collected electronics consolidated at recycling facility (municipal- or contractor-operated) for subsequent shipment to recycler.

Frequency: Optimally, as frequent as general curbside collection of containers, paper, etc. Could be less frequent (e.g., with other bulky wastes, special collection days), depending on local implementation.

Principal Advantages: Convenience to residents; Builds on existing program.

Principal Disadvantages: High collection cost; Possible need to add staff and equipment; Need to renegotiate collection contracts; Coverage (only up to 60% of state residents).

2. Dropoff at Local Recycling Dropoff Locations

Description: Residents take electronics to established municipal dropoff recycling locations, where electronics are consolidated and packed for shipment to recycler.

Frequency: Optimally, corresponding to current dropoff recycling hours. Individual municipalities could establish less frequent hours.

Principal Advantages: Convenience to residents; Low incremental cost to implement; Builds on existing program.

Principal Disadvantages: Coverage (not all municipalities have dropoff sites); Illegal dumpint and scavenging (most dropoff locations are not staffed); Consolidation requirements (shipping is cost effective only if truckload volumes are accumulated).

3. Dropoff or Curbside Collection During Local Spring Cleanup Days

Description: Depending on local implementation, residents set out electronics at curbside with other 'spring cleanup' items, or bring electronics to a dropoff location set up for local spring cleanup.

Frequency: Typically 1x or 2x per year.

Principal Advantages: Convenience to residents; Low incremental cost to implement; Builds on existing program; Large quantities collected in short period simplifies and reduces transportation cost.

Principal Disadvantages: Low frequency (discourages participation); Coverage (not all municipalities have spring cleanup or equivalent)

4. Dropoff at Local/Regional Recycling Centers

Description: Residents transport electronics to one of approximately 100 publicly and privately operated recycling centers, where they are consolidated, packed, and shipped to a recycler.

Frequency: Optimally, corresponding to current dropoff recycling hours. Individual recycling centers could establish less frequent hours.

Principal Advantages: Coverage (essentially 100% of Iowans have access); Low incremental cost to implement; Consolidation (recycling centers set up for consolidation; smaller number of locations implies more rapid collection of truckload volumes).

Principal Disadvantages: Complexity of implementation (securing cooperation from 100 +/- individual recycling centers, cost allocation); Inconvenience to residence (distance to collection centers, hours); Probable low participation.

5. Dropoff at Regional Household Hazardous Waste (HHW) Collection Centers

Description: Residents transport electronics to one of approximately 30 sites in Iowa set up to handle HHW. Electronics are consolidated at these sites, packed, and shipped to recyclers.

Frequency: Presumably on the same schedule as current HHW collection at each site. This varies widely, from nearly full-time staffing at some sites, to 1x or 2x per year at some satellite locations.

Principal Advantages: Builds on existing program; Relatively low incremental cost to implement.

Principal Disadvantages: Coverage (not all Iowans have access to permanent HHW collection sites); Complexity of implementation; Complex transportation logistics; Inconvenience to residents; Probable low participation; Infrequency; Sites not set up to handle or store electronics.

6. Dropoff at Iowa DOT Garages

Description: Residents transport electronics to one of up to 100 IA DOT garage locations. Electronics are consolidated at these sites, packed, and shipped to recyclers.

Frequency: To be determined.

Principal Advantages: Locations already established and secure; Coverage (IA DOT garage network is statewide)

Principal Disadvantages: Inconvenience to residents; Probable low participation; Complexity of implementation (entire new program to plan, implement, and staff); Cost of implementation; Low likelihood that many DOT garage locations are set up to handle and store electronics. Requires interagency agreement and substantial DOT cooperation (particularly difficult in light of DOT reorganizations and likely closure of some number of satellite garages).

7. Dropoff Using the Best Buy Return Program

Description: Residents transport electronics to Best Buy store locations, where they are collected and packed for shipment to recyclers.

Frequency: Currently, Best Buy is scheduling collection events no more frequently than one or two weekends per year at individual store locations. Presumably the state could work with Best Buy to establish more frequent collection events.

Principal Advantages: Builds on established program; Potential that Best Buy would absorb some costs

Principal Disadvantages: Inconvenience to residents; Coverage (only 5 Best Buys in Iowa); Probable low participation; Complexity of implementation (demands successful negotiations with Best Buy).

8. Dropoff at Other Retailer Locations

Description: Residents transport electronics to retailers engaged by the state to participate in electronics takeback. At retail locations, electronics are consolidated, packed, and shipped to recyclers.

Frequency: Depends on implementation negotiated with (or mandated to) retailers. Could be as frequent as continuous collection, as infrequent as 1x or 2x per year per location.

Principal Advantages: Coverage (could be extended to sites throughout Iowa)

Principal Disadvantages: Inconvenience to residents; Probable low participation; Extremely complex implementation.

9. Consumer / Small Business Mailback Program

Description: Consumers package electronics for shipment to recycler. Consumers take electronics to shipping location (e.g., any UPS shipping point), or possibly call for pickup at their home or business location.

Frequency: On demand

Principal Advantages: Coverage; On-demand availability to consumers; Possibility to coordinate with programs already set up by HP, IBM, Compaq.

Principal Disadvantages: Inconvenience to consumers; Not suited to handle televisions; Cost; Highly complex implementation (need to involve many public and private parties).

3.5.3 Options to Fund CEE Recycling

Funding will be required to pay for any electronics recycling implemented in Iowa, whether a one-time, pilot collection in a single-municipality or a long-term statewide initiative. If the state chooses to implement one or several pilot programs, the relatively small expense involved could be funded from regular appropriations, or handled by individual municipalities or waste districts. How to generate such funding will not be addressed here.

Much more significant is how the state might fund permanent, statewide recycling for used electronics. **Table 3-4** provides an overview of nine different options. Including different implementation scenarios for each option, these can be differentiated into a total of fifteen different alternatives to fund electronics recycling in Iowa. These are summarized below, and are described fully in **Appendix C**.

Three options entail direct state funding of electronics recycling:

1. Sales tax revenues associated with purchases of computers and other electronic equipment would be captured and diverted to fund electronics recycling.
2. A portion of currently collected landfill surcharges would be designated to fund electronics recycling.
3. The state would establish funding for electronics recycling from other state revenue sources.

Another three options would shift payment for electronics recycling to the consumer. Under different implementation scenarios, the consumer could subsequently be reimbursed for this payment, either by manufacturers, or through a deposit-refund system.

4. The consumer would pay an “advance disposal fee” (ADF) at the time equipment is purchased, and these fees would be used to pay for statewide electronics recycling. Under two possible implementation scenarios, the consumer would subsequently be reimbursed for the ADF payment via a cash or merchandise rebate from manufacturers.
5. The consumer would pay a recycling fee at the time he/she recycles used equipment. Under two possible implementation scenarios, the consumer would subsequently reimbursed for the recycling fee via a cash or merchandise rebate from CEE manufacturers.

6. The consumer would pay a deposit at the time new equipment is purchased. All or a portion of this deposit would subsequently be refunded to the consumer at the time the same piece of equipment is recycled.

The final three options would shift payment directly to CEE manufacturers or retailers:

7. Iowa would set up a fund to pay for electronics recycling, and requires manufacturers selling electronic equipment in Iowa to pay into this fund.
8. Manufacturers would be required to establish, fund, and manage an electronics recycling program, with state oversight but without significant direct state involvement.
9. Manufacturers and/or retailers would be provided with tax or other indirect incentives to establish an electronics takeback program.

Table 3-4 summarizes each financing option against a number of evaluation criteria, including

- The incentive provided to consumers to recycle surplus CEE;
- The possibility that funds could be "parasitized" to other purposes;
- Cost and complexity to implement, to consumers, the state, retailers, and manufacturers;
- Allocation of responsibility for paying for recycling among the state, consumers, and manufacturers;
- Likelihood of resistance to implementation, from the state (agencies and/or legislature), consumers, retailers, and CEE manufacturers.

Table 3-4
Overview of Options to Fund Statewide Electronics Recycling

	OPTION 1		OPTION 2	OPTION 3	---------- OPTION 4 ----------				---------- OPTION 5 ----------			OPTION 6	OPTION 7		OPTION 8	OPTION 9
	A	B			A	B	C	D	A	B	C		A	B		
	Capture current sales tax $$	Capture current sales tax $$	CEE recycling fund from current LF surcharges	CEE recycling fund from other state revenues	Consumer-paid Advance Disposal Fee	Consumer-paid Advance Disposal Fee	Consumer-paid Advance Disposal Fee	Consumer-paid Advance Disposal Fee	Consumer-paid recycling fee	Consumer-paid recycling fee	Consumer-paid recycling fee	Deposit-Refund program	Manufacturer-paid recycling fund	Manufacturer-paid recycling fund	Mfr-paid & administered recycling pgm	Manufacturer incentive
	CEE purchase $$ reported by vendors	CEE purchase $$ estimated by state				Manufacturers match consumer ADF payments	Cash rebate paid by mfrs	Merchandise rebate provided by mfrs		Cash rebate paid by mfrs	Merchandise rebate provided by mfrs		Mfr payment linked to mfr sales	Mfr payment linked to other metric		
EVALUATION FACTORS																
Who pays?	Consumer	Consumer	State	State	Consumer	Consumer & Manufacturer	Consumer	Consumer	Consumer	Consumer	Consumer	Consumer	Manufacturers	Manufacturers	Manufacturers	Manufacturer
Are they reimbursed?	No	No	No	No	No	No	Yes	Yes (Merchandise)	No	Yes	Yes (Merchandise)	Yes (when equip retired)	No	No	No	Yes (Indirect)
Consumer Incentive to Recycle	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No
Possibility of funding parasitism	Yes	Yes	Yes	Yes	Possible	Possible	Possible	Possible	No	No	No	Possible	Possible	Possible	No	No
Builds on existing precedent or program	Yes	Yes	Yes	Yes	Partial	Partial	Partial	Partial	Yes	No	No	Yes	No	No	No	No
Complexity, consumer	None	None	None	None	Low	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Low	None	None	Depends on Implementation	None
Complexity, state	Moderate	Moderate	Moderate	Depends on Implementation	High	High	High	High	Low-High (Depends on Implementation)	Low-High (Depends on Implementation)	Low-High (Depends on Implementation)	High	Mod - High	Mod - High	Moderate	Mod - High
Complexity, retailer	Moderate	Moderate	None	None	Mod - High	Mod - High	Mod - High	Mod - High	None	None	None	Mod - High	None	None	None	None
Complexity, manufacturer	None	None	None	None	None	Moderate	Mod - High	Mod - High	None	Mod - High	Mod - High	None	Low - Mod	Low - Mod	High	Mod - High
Industry responsibility financial	No	No	No	No	No	Yes	Yes	Yes (Indirect)	No	Yes	Yes (Indirect)	No	Yes	Yes	Yes	Yes (Partial)
Industry responsibility management	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes
Resistance, state	Almost certain	Almost certain	Almost certain	Almost certain	Probable	Probable	Uncertain	Uncertain	Probable	Uncertain	Uncertain	Probable	Uncertain	Uncertain	Uncertain	Uncertain
Resistance, consumer	Unlikely	Unlikely	Unlikely	Unlikely	Almost certain	Probable	Uncertain	Uncertain	Almost certain	Uncertain	Uncertain	Probable	Unlikely	Unlikely	Unlikely	Unlikely
Resistance, retailer	Unlikely	Unlikely	Unlikely	Unlikely	Probable	Probable	Probable	Probable	Unlikely	Unlikely	Unlikely	Almost certain	Unlikely	Unlikely	Uncertain	Uncertain
Resistance, manufacturer	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Probable	Probable	Unknown	Unlikely	Almost certain	Uncertain	Unknown	Almost certain	Almost certain	Almost certain	Probable

Tables 3-5, 3-6, and 3-7 present this information in a different way, evaluating each option against the separate of complexity, the possibility of parasitism, and their ultimate allocation of financial responsibility for recycling.

Complexity. **Table 3-5** ranks the funding options according to their complexity (and, by proxy, cost) to consumers, to the state, to retailers, and to electronic equipment manufacturers. None of these programs would impose a significant overhead burden on consumers, although the rebate-based and deposit-refund programs would impose moderate administrative chores on households and participating businesses. According to this metric, the advance disposal fee, deposit-refund system, and manufacturer incentive program would be most complex for the state to set up and manage, as each would involve setting up an entirely new administrative program. Financing CEE recycling through sales tax funds, landfill surcharges, or other state funds would be similarly complex, but because these options would piggyback onto existing state programs, they are judged to be incrementally much less complex. Retailers would be most impacted by imposition of an advance disposal fee or deposit-refund program. All other programs would have little impact, or in the case of a sale tax-based program, a moderate impact on retailers (because it would build on already established reporting and recordkeeping systems). The three manufacturer-reliant options would clearly impose substantial overhead burdens on members of the electronics industry, as would the ADF-rebate and recycling fee-rebate systems.

Table 3-5
Recycling Funding Options Ranked According To Complexity

Sector	COMPLEXITY		
	None or Low	Moderate	High
Complexity To Consumers	Sales Tax (1) Landfill Surcharges (2) Other State Revenue (3) ADF (4A) Recycling Fee (5) Mfr. Recycling Fund (7) Mfr. Program (8) Mfr. Incentive (9)	ADF w/ Rebate (4B, 4C) Rec. Fee w/ Rebate (5B, 5C) Deposit-Refund (6)	
Complexity To The State	Recycling Fee (5) Rec. Fee w/ Rebate (5B, 5C)	Sales Tax (1) Landfill Surcharges (2) Other State Revenue (3) Mfr. Recycling Fund (7) Mfr. Program (8)	ADF (4A) ADF w/ Rebate (4B, 4C) Deposit-Refund (6) Mfr. Incentive (9)
Complexity To Retailers	Landfill Surcharges (2) Other State Revenue (3) Recycling Fee (5) Rec. Fee w/ Rebate (5B, 5C) Mfr. Recycling Fund (7) Mfr. Program (8) Mfr. Incentive (9)	Sales Tax (1)	ADF (4A) ADF w/ Rebate (4B, 4C) Deposit-Refund (6)
Complexity To Manufacturers	Sales Tax (1) Landfill Surcharges (2) Other State Revenue (3) ADF (4A) Recycling Fee (5) Deposit-Refund (6)		ADF w/ Rebate (4B, 4C) Rec. Fee w/ Rebate (5B, 5C) Mfr. Recycling Fund (7) Mfr. Program (8) Mfr. Incentive (9)

Potential That Funds Could Be Parasitized. A potential danger for any state-financed recycling program is that funds could be "parasitized" for other end uses, especially in times of relative financial hardship. **Table 3-6** summarizes this possibility for each of the recycling funding mechanisms. This possibility is judged to be relatively high for the sales tax, landfill surcharge, and other direct state funding options, particularly because these funds are currently being collected and used for other purposes. The possibility is less for the ADF, deposit-refund, and manufacturer-paid recycling fund, because safeguards against parasitism could be written into enabling legislation. Programs financed directly by consumers (recycling fees) or by industry face essentially no danger of parasitism.

Table 3-6
Recycling Funding Options Ranked According to the Possibility of Funds Being Parasitized for Other Purposes

Potential for Parasitism of Funding Source		
Low	**Moderate**	**High**
Recycling Fee (5) Mfr. Program (8) Mfr. Incentive (9)	ADF (4) Deposit-Refund (6) Mfr. Recycling Fund (7)	Sales Tax (1) Landfill Surcharges (2) Other State Revenue (3)

Financial Responsibility for Recycling. One of the most contentious issues related to electronics recycling concerns who, ultimately, should pay to recycle used equipment — consumers, the state, or manufacturers. The financing options outlined here have very different implications in this regard, which are summarized in **Table 3-7**. Of the nine options and implementation scenarios outlined, four would make consumers of electronic equipment directly responsible for supporting CEE recycling. These are the sales tax, the advance disposal fee, the recycling fee, and the deposit-refund. Two options are directly financed by the state: tapping landfill surcharges; and using other state revenues (These funds, too, ultimately come from consumers, but from a broad taxpayer base, not only consumers who purchase and discard computers and other electronics). Two options would pass recycling charges directly to manufacturers: the manufacturer-funded recycling fund, and the manufacturer-funded and -managed recycling program.

Table 3-7
Recycling Funding Options Evaluated According to the Ultimate Allocation of Payment to Support Recycling

Party Ultimately Paying for Electronics Recycling			
Consumer	**State**	**Manufacturer**	**Shared**
Sales Tax (1) ADF (3) Recycling Fee (5) Deposit-Refund (6)	Landfill Surcharge (2) Other State Revenue (3)	Mfr. Recycling Fund (7) Mfr. Program (8)	ADF w/ Rebate (4B, 4C) Rec. Fee w/ Rebate (5B, 5C) Mfr. Incentive (9)

Five possible implementation scenarios would, in Wuf's view, provide shared financial responsibility. Four of these are the ADF-rebate and recycling fee-rebate scenarios, in which consumers make a direct payment to finance CEE recycling, but subsequently have the opportunity to be reimbursed (in cash or merchandise) for all or part of this payment. There is a substantial difference between the cash and merchandise rebate. The cash rebate transfers the full cost of CEE recycling on to the manufacturer. (We call this "shared responsibility" because of the certainty that a large fraction of rebates will not be redeemed.) The merchandise rebate, on the other hand, requires the consumer to assume the full cash cost of recycling. While the manufacturer gives something of economic value in return, this is not cash

compensation to the consumer, nor a cash cost to the manufacturer. For tax purposes, the rebate would be a non-cash expense to the manufacturer, and it would in fact provide the manufacturer with partially compensating benefits (additional sales opportunities, customer retention opportunities, etc.). The manufacturer incentive program also provides for shared responsibility, in that the state would provide economic benefits to manufacturers which would partially compensate them for establishing and maintaining a manufacturer-paid recycling program.

3.7 Identification of Potential Partners

Wuf has identified three potential in-state partners that might provide logistics support in implementing pilot or permanent CEE recycling in Iowa — one government, one non-profit, and one private.

Iowa Prison Industries (IPI) is a possible government sector partner. IPI currently handles nearly all surplus computers generated by Iowa state agencies in the Des Moines area. IPI handled about 2,000 computers in 2000, and expects about the same volume in 2001. IPI's services include pickup and transportation from agency locations, hard disk wipe clean, equipment upgrade, and resale to purchasers qualified to buy from the state surplus system. IPI strips and either re-uses or re-sells components from PCs too old to refurbish, and arranges for destructive recycling of equipment that it cannot handle internally (with recycling costs passed on to the generating state agency). IPI's Des Moines manager has stated that he has the capacity to handle more equipment, including equipment coming from non-government sources, and would consider expanding operations in some sort of partnership with the state. IPI's primary requirement in considering expansion is to be guaranteed that expansion would be revenue-neutral or revenue-positive — that is, that any financial deficits incurred by IPI would be reimbursed.

Advantages of this Partnership

- IPI's recycling program is already established and successful
- Low labor cost ($0.50/hour) dramatically lowers revenues required to break even
- Has stated willingness to expand as long as revenue-positive
- Great public relations to demonstrate IPI's commitment and success in an environmental initiative, interagency coordination, etc.
- Sales outlets to schools and nonprofits are consistent with state's social goals to return used equipment to socially meaningful use
- Possible that prison vehicles and labor could be used for return transportation logistics, if capacity (time, vehicles, labor) is available.
- Possible to expand beyond Des Moines using inmate labor from other correctional facilities.

Disadvantages of this Partnership

- Single location. Unclear that IPI would be willing to set up multiple locations to handle equipment from around the state.
- Capacity. Although one can envision this operation doubling or tripling in capacity, it is hard to imaging IPD expanding to meet a significant fraction of statewide need
- Could have to develop independent transportation network. Although IPI has trucks moving statewide, unclear that it's feasible to use these for CEE logistics.

Goodwill Industries. Wuf contacted Goodwill representatives in two regions of the state and confirmed their interest in a potential partnership. Goodwill operates in five districts in Iowa. These are loosely knit affiliates, each developing and operating its own programs without central statewide management. Goodwill has some history of involvement with in CEE, with programs currently operating in at least four states (Massachusetts, Pennsylvania, Texas, California). In the past, at least one of the Iowa Goodwill chapters accepted donations of CEE; it halted the practice because it was not set up to recycle the equipment it received, which therefore became a disposal liability. Goodwill operates a network of retail stores which might be used as recycling dropoff points.

Goodwill employs a mentally and./or physically disadvantaged workforce to perform light industrial operations analogous to many computer recycling procedures (e.g., manual disassembly). In the two chapters contacted, Goodwill has access to workers to perform computer recycling operations, but does not have management capabilities or expertise. Nor does Goodwill have independent financial resources to make a commitment to electronics recycling. For these reasons, the contacts indicated that Goodwill would be unlikely to make a commitment to CEE recycling on a pilot basis, but would require a long-term commitment from the state, along with financial guarantees that would make CEE recycling at least revenue-neutral.

Advantages of this Partnership

- Workforce suited to many CEE recycling tasks (disassembly, component removal, etc.)
- Relatively low cost workforce, reducing financial requirements to break even
- Division into 5 Iowa districts means commitment would not have to be statewide
- Social benefits accrue to supporting an organization such as Goodwill
- Goodwill-owned fleet of trucks could participate in transportation from collection sites.
- Goodwill has network of sales locations throughout the state

Disadvantages of this Partnership

- Both Iowa chapters stated they would be unwilling to participate in a pilot program — too great a commitment of resources unless they are assured the program will be permanent
- Neither Iowa chapter has capability now in place to recycle used CEE. Would have to build capabilities from scratch
- Unclear that Goodwill management or workforce has capability to perform refurbishment and equipment upgrade for resale (the highest value use for recycled in CEE), or other sophisticated demanufacture and marketing functions.
- Goodwill does not have network to sell recovered components (e.g., chips, hard drives, etc.) and commodities (metal, plastics). Would have to develop marketing capabilities.
- Goodwill's outlets (Goodwill stores) are unlikely to optimize revenue from used equipment sales.
- Goodwill wages are not significantly below market rates. Unclear that Goodwill could break even without long-term subsidy, given concerns re labor force skills and ability to optimize sales revenues from used equipment and components.

Midwest Computer Brokers. Midwest Computer Brokers (MCB) is a full service electronics recycler in Cedar Rapids (see Section 2.1.2). They are the largest CEE recycler in Iowa, and the only Iowa recycler capable of providing a full range of recycling services (resale, component recovery, etc.). MCB is seeking avenues to expand its presence in Iowa, and has participated in setting up several local/regional

CEE recycling programs in partnership with Iowa municipalities, waste districts, and institutions, in addition to corporate clients. MCB's basic pricing structure for CEE recycling services is quite favorable compared to most other players in its industry, and MCB has expressed interest in working with the State on a CEE recycling partnership, either on a pilot or long-term basis.

Advantages of this Partnership

- MCB has experience in residential and small business recycling, has helped organize 3 or 4 county or planning area programs in Iowa, and is the recycler for the Bluestem (Linn Cty) program
- MCB is already recycling large quantities of equipment essentially identical to residential/small business mix. No training, financial input, new staff, or other requirements to set them up
- MCB is the only in-state recycler capable of handling the range of equipment generated by consumers and small businesses
- Low recycling cost compared to most other recyclers.
- MCB can probably organize logistics of collecting from multiple sites.
- Has offered to participate in a pilot
- Would help a growing Iowa business continue expansion.

Disadvantages of this Partnership

- Can the state "give" a program to a private recycler without a competitive process. (Is there a difference between pilot program and permanent program?)
- No employment, job training, and related benefits that would adhere to working with a nonprofit or with Iowa Prison Industries

Other Possible Partners. Wuf also evaluated other possible partnering opportunities. Some of these are unlikely to bear fruit. Others may prove valuable as sources of financial assistance or assistance with some fraction of Iowa's CEE waste stream, but not with the spectrum of issues and equipment Iowa will ultimately have to address.

The Cedar Rapids **REACT Center** (see Section 2.1.2) is a nonprofit that is effectively addressing CEE recycling needs for a number of small and large firms in the Cedar Rapids area, and distributing refurbished computer systems to schools throughout the state. This is a local initiative spearheaded and funded by a single Cedar Rapids firm, however. Although REACT might be willing to share expertise with similar organizations established elsewhere in Iowa, neither REACT nor its corporate sponsor (Rockwell Collins, Inc.) is interested in expanding REACT's geographic coverage or throughput. The **Recycle Old Computers Kindly** (ROCK) initiative in Des Moines is in a similar position; it does not have the management capabilities, resources, or ultimately the interest in significantly expanding its operations to fulfill a statewide recycling role.

Trade or industry associations might be influenced to play a part in CEE recycling in Iowa. The **Electronic Industries Alliance** (EIA) has provided grant funding to several organizations in support of residential CEE recycling, and might be induced to do so in Iowa as well. The **Rechargeable Battery Recycling Corporation** (RBRC) is an industry-sponsored organization focused specifically on recycling rechargeable batteries from consumer electronics, and would be supportive of Iowa recycling efforts targeted at these items.

Individual corporations are possible partners. The electronics retailer **Best Buy** is sponsoring a nationwide series of collection events at up to several dozen of its store locations, and Iowa DNR has contacted Best Buy about running such an event at an Iowa. But with only five locations in Iowa, Best Buy cannot be more than a minor player in statewide recycling efforts. Other chain retailers might be engaged by the state in similar initiatives, but would suffer from the same demographic disadvantages as Best Buy (i.e., chain retail stores are concentrated in Iowa population centers, leaving large areas of the state unserved). Consumer electronics manufacturers **Panasonic** and **Sony** have been deeply involved in state recycling pilot programs, particularly in Minnesota (see Section 1.3.3). But to date, these have been pilot initiatives, and the firms' financial commitment has been limited. As discussed in Section 1.3, computer OEMs **Compaq**, **Gateway**, **Hewlett-Packard**, and **IBM** all operate independent recycling programs for consumer-generated computers and related equipment. Only Compaq and Gateway have demonstrated any meaningful financial commitment through these programs however, and it is likely that none of the OEMs would look favorably on a "partnership" that entailed a serious financial commitment in Iowa, or, more particularly, entailed any sort of commitment to "shared responsibility" for managing used equipment. And none of these firms would be likely to consider voluntary involvement in a recycling program dealing with televisions in addition to computers.

One national waste firm, **Waste Management, Inc.** (WMI) (which has an extensive presence in Iowa) has set up a business practice in electronics recycling, and has been deeply involved in pilot electronics recycling initiatives in Minnesota. WMI might be willing to consider a role as a recycling partner in Iowa, if the partnership allowed the company to meet its expected internal rate of return for any investment made in the state.

SECTION FOUR

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of this analysis rest on three principles:

1. State action should not duplicate actions already being undertaken, or likely to be undertaken, by the private sector. State action is needed most to accomplish objectives that are unlikely to be achieved through the private sector.
2. State action should build on existing programs and infrastructure, and should be structured to optimize convenience to users, and cost effectiveness to users and to the state.
3. Responsibility for managing electronic equipment at its end-of-life should be shared among all of those who are associated with its use and disposal.

The first of these is a basic tenet of environmental policy — policy is most needed to address environmental issues that are not dealt with through the functioning of private markets, either because markets fail to internalize the costs of their environmental ramifications, or because markets fail to reach all of those affected by an environmental concern. In the case of end-of-life electronics, markets are not yet reaching to address some waste streams and some generators of possible concern, and state action may be appropriate to do so.

The second principle is also part of the foundation of sound policy. Particularly in a field like waste management, it make little sense to build all-new infrastructure alongside of infrastructure that already exists, already reaches every household in the state, already provides cost-effective service, and is already well known and accepted by consumers.

The third principle generates controversy. Waste management in the U.S. has historically been viewed and acted upon as an issue entirely independent from the production and use of the goods that are disposed of. More to the point, product manufacturers have been entirely separated from the cost and logistics of product disposal, which have been absorbed as a public function. For many reasons, electronic equipment has become a lightning rod for re-evaluation of this long-held position toward the management of surplus goods in the American economy, and there is growing momentum — at least for electronics — to recognize that manufacturers can and should bear some responsibility for the end-of-life management of their products. The third principle makes this recognition explicit.

Achieving the goal of capturing and recycling electronic equipment is not dependent on establishing shared responsibility between manufacturers and users, and all of the logistics options recommended here can be implemented without any involvement at all from electronics manufacturers. But to do so will be expensive, much more expensive than it has been to implement recycling for paper, metals, and other common consumer items. This analysis recommends that manufacturers be asked to assume a portion of that cost.

4.1 Mandatory vs Non-Mandatory Initiatives

This analysis makes no recommendation regarding whether or not the state should mandate recycling of computers, computer monitors, televisions, or any other electronic equipment. To make such a recommendation is beyond the scope of the analysis commissioned for this study.

It is clear that there are potentially serious environmental issues associated with the disposal of used electronics, particularly of computer monitors and televisions, and that these issues will expand in importance as the size of this waste stream continues to grow in coming years. And it is clear that national policy discussions will continue to focus on the electronics waste stream, with the probable

outcome that more and more states, and potentially the federal government, will come to establish legal and regulatory policies regarding the disposition of used electronics. But it is equally clear that nothing like a national consensus exists regarding either the environmental hazards associated with electronics disposal, or appropriate measures to address this waste stream. If consensus on these issues did exist, there would be many more substantive activities to review from other jurisdictions, and many more policies for Iowa to consider as templates for its own.

Iowa can choose one of three paths. It can wait and watch the development of policies in other states and the federal government, and then build upon actions taken elsewhere. It can take limited policy steps — such as implementation of pilot recycling programs in a few parts of the state — to test policy and operating models and establish a foundation of public acceptance for electronics recycling. Or it can take more aggressive steps to foster or mandate statewide recycling of electronics, steps which would place the state at the forefront of the national dialogue regarding end-of-life electronics. Which path to choose is a decision that rests with Iowa's legislature, executive branch, and the many constituencies potentially involved and affected by statewide electronics recycling policy. The charge of this analysis has been to contribute information to help support such a decision and spell out its implications. But to recommend the decision itself is not Wuf Technologies' charge.

4.2 Generators and Waste Streams of Greatest Importance

4.2.1 Generators

As discussed in Section 3.1, small businesses and individual consumers are clearly the highest priority generating sectors for public policies to enhance recycling opportunities for surplus electronic equipment. Large businesses and institutions have access to the information and resources required to assure proper management of end-of-life electronics, and developments in the electronics recycling industry will continue to work primarily to the benefit of these generators. But without government involvement, recycling opportunities for individuals and small businesses are not likely to come into being on any meaningful scale.

This is true whether or not Iowa's government chooses to mandate recycling of used electronics. A government recycling mandate would enhance and accelerate the trends that are already promoting increased recycling of electronics from large businesses and institutional generators. But a recycling mandate would not have a similar impact for small businesses and individuals. The economic barriers to recycling among these sectors are simply too great, and only some level of direct government involvement is likely to have the impact of fostering development of cost-effective electronics recycling for these sectors.

4.2.2 Waste Streams

The highest priority waste streams for policy intervention are (1) personal computers, (2) computer monitors, and (3) televisions. Monitors and televisions stand out as environmental concerns because of their leaded glass content. Personal computers stand out because of their number, the hazardous waste concerns associated with batteries, circuit boards, fire retardants, and some other PC constituents, and more elusive concern about the irresponsibility of discarding equipment that may be perfectly functional to secondary users.

Other electronics waste streams might be captured in recycling programs targeted at PCs, monitors, and televisions, but from an environmental and policy perspective are of comparatively less importance. In general, the environmental impacts associated with their disposal are low, as is their residual technology value. An exception might be items that contain rechargeable nickel-cadmium batteries — items such as camcorders plus cordless and cellular phones — which are a significant source of cadmium in the U.S. waste stream.

4.3 Options to Implement Statewide Electronics Recycling

Of the nine recycling infrastructure options discussed in **Section 3.5**, we believe that two stand out. These are coordination of electronics recycling with the "spring cleanup days" held by most Iowa communities, and addition of electronics to the recyclables handled at the state's network of public and privately operated recycling centers. The major advantages and disadvantages of these options are summarized in **Table 4-1**. These options most nearly satisfy the multiple evaluation factors enumerated in **Section 3.3**, and stand out in particular in terms of their universal coverage, convenience, consistency with existing programs (including use of existing facilities), and manageable logistics. The most serious disadvantage of the "spring cleanup day" option is that it entails collection and transportation of recovered electronics from hundreds of generation points; this is moderated by the fact that the collection would be scheduled only once a year so that, once institutionalized, the annual logistics push would not have to be re-planned from scratch. The most serious disadvantage of using the approximately 100 regional recycling centers in the state is inconvenience (i.e., long travel distance) for some proportion of Iowans; this is moderated by the fact that the geographic distribution of recycling centers can be expected to mirror the distribution of Iowa's population, so that the majority of Iowans should not be subject to this inconvenience.

Table 4-1
Recommended Policy Options: Electronics Recycling Infrastructure

Option	Principal Advantages	Disadvantages
Local Spring Cleanup Days	• Convenience and simplicity to user • Builds on existing services and infrastructure • Statewide coverage • Low incremental cost to implement	• Unclear that coverage is universal to all Iowa communities • Large number of collection points (complex transport logistics) • Only 1x or 2x per year
Local/Regional Recycling Centers	• Simplicity to user • Builds on existing services and infrastructure • Statewide coverage • Low incremental cost to implement	• Inconvenience (long travel distance) for many Iowans • Requires cooperation from multiple third parties

Table 4-2 summarizes the considerations which influenced Wuf Technologies to recommend against the remaining infrastructure options.

Table 4-2
Principal Disadvantages of Options Not Recommended: Electronics Recycling Infrastructure

Option	Principal Disadvantages
Curbside	• Lack of statewide coverage[1] • Typically, many businesses are not served
Local Dropoff Centers	• Most centers are not staffed (uncontrolled dropoff is not acceptable for electronics) • Complex logistics to return from dropoff centers to recycler(s) • Lack of storage capacity at many dropoff sites
Regional HHW Collection Centers	• Lack of statewide coverage • Inconvenience to residents (travel distance, handling) • Lack of storage capacity at many sites • Lack of truck loading capabilities • Need for additional staff
Iowa DOT Garages	• Inconvenience to residents (travel distance, handling, fact that sites are not well known) • Lack of storage capacity • Lack of truck loading capabilities • Need to staff electronics collection • Difficulty in publicizing effectively (does not build on existing program)
Best Buy Return Program	• Lack of statewide coverage • Inconvenience to residents (travel distance, handling) • Relies on third party cooperation
Other Retailer Return Program	• Inconvenience to residents (travel distance, handling) • Very complex logistics • Relies on coordination with and cooperation from dozens, potentially hundreds of third parties • Difficulty in publicizing effectively (does not build on existing program)
Mail-Back Program	• Inconvenience to residents (packing, shipping) • Complex logistics • Cost • Difficulty in implementing and publicizing (Does not build on existing program)
Notes: [1] Could be a viable option implemented in communities with curbside recycling pickup	

4.4 Options to Finance Statewide Electronics Recycling

Of the financing options presented in Section 3.5, Wuf Technologies believes that three financing options stand out as the most promising to finance statewide electronics recycling for consumers and small businesses. These are:

1. An **Advance Disposal Fee** with a manufacturer match;
2. An **Advance Disposal Fee** with a manufacturer merchandise rebate to the consumer;
3. Capture of **Current Sales Tax Revenues**, with a manufacturer match.

All three rely on a similar mechanism to capture revenue to pay for electronics recycling, namely a fee or tax paid by the consumer at the time a new piece of electronic equipment is purchased. The Advance Disposal Fee (ADF) would amount to a new sales tax levied on specified items that would generate revenue specifically to fund electronics recycling. Alternatively, current sales taxes that are already levied on these items could be captured and diverted to fund recycling. From the consumer's perspective, the ADF would add to the cost of the item, while capture of current sales taxes would not. The consumer could be expected to prefer the latter. From the state's perspective, capturing current sales tax revenues would reduce tax funds available for other purposes, while the ADF would not. Most lawmakers could be expected to prefer the latter. As regards basic implementation, the two options are nearly indistinguishable, in that the hardware, software, and tracking and accounting mechanisms required to calculate taxes owed and deliver them to the state are already in place.

One important feature of both of these options is this: There is no reason to limit the items on which the ADF or captured sales tax is levied to electronic hardware. No consumer or business purchases a computer for the sake of owning a computer. A computer is purchased as a vehicle for the use and enjoyment of software, games, the internet, and other products and services. No consumer has ever purchased a television in order to own a television. A TV is purchased as a vehicle to enjoy programming, movies, games, DVDs, and other services. If the cost of electronics recycling is to be spread over the goods and services responsible for the need for electronics recycling, the State might well consider the possibility of extending the ADF (or the items targeted for sales tax capture) to most or all of the goods and services related to the use and enjoyment of computers and video equipment — for example, software, gaming hardware and software, DVDs, internet services, cable and satellite television services, and others. This approach would represent a realistic allocation of recycling costs across all of the goods and services responsible for creating the need and demand for recycling computers, monitors, and related products. The nearly universal use of inventory tracking and management software, and the accounting mechanisms already in place to track Iowa's sales and use tax, would make this a relatively straightforward extension of the ADF or captured sales tax approach.

All three of these options also rely on one of two forms of manufacturer match to provide part of the funding for electronics recycling.

One of these is simple: For each dollar in ADF or targeted sales tax revenues collected, the manufacturer of the taxed product is required to pay a matching sum — which could be less than, equal to, or greater than the amount paid by the consumer. The sum of all consumer and manufacturer payments would be the total amount required to pay for statewide electronics recycling. Simple in concept, this option would in fact entail relatively sophisticated administration, in which the state tracks sales information by manufacturer, and then periodically invoices all affected manufacturers for their share of the manufacturer match. The inventory management and accounting software now almost universally used by electronics retailers should make this exercise straightforward and largely automatic, despite its outward complexity.

The second manufacturer match option is entirely different. Under this option, consumers would pick up the entire cost of statewide electronics recycling through the ADF or captured sales tax. The manufacturer would then compensate the consumer with a rebate against the purchase just completed or a future purchase. Again, the match could be less than, equal to, or greater than the amount of the ADF or

sales tax paid by the consumer. This option might be more complex to administer than the manufacturer cash match — although once again the sophistication of product tracking software would reduce this barrier. But compared to the cash match, it might more easily gain acceptance among manufacturers because the rebate would not represent a cash outlay, it would offer sales and marketing opportunities that would otherwise be costly to develop, and it would separate them from direct financial responsibility for recycling (which is an important policy goal for the industry). The flexibility inherent in this approach might in fact make it economically attractive to manufacturers. For example, a consumer who purchases a new computer might be offered a "rebate" against the purchase of related products like printers, software, or games — providing immediate sales opportunities of significant value to the manufacturers of these products and services.

We believe that other options suffer from debilitating disadvantages, which are outlined in **Table 4-3**.

Table 4-3
Principal Disadvantages of Options Not Recommended: Paying for Electronics Recycling

Option	Principal Disadvantages
Capture Current Landfill Surcharges	• Funding source is already fully accounted for • Reduces funds available for other programs • No manufacturer responsibility
Use Other State Revenues	• Reduces funds available for other programs • Subject to annual appropriation; Likelihood of parasitism • No manufacturer responsibility
Advance Disposal Fee without Manufacturer Match or Rebate	• Administrative complexity • No manufacturer responsibility
Consumer Recycling Fee	• Disincentive to consumer to recycle; Probable low participation and capture • Administrative complexity • No manufacturer responsibility
Deposit-Refund	• Difficult to establish refund with long-lived equipment • Difficult to manage refund with equipment that changes ownership • Deposit must be greater than refund to pay for recycling; this reduces incentive to consumer to recycle and redeem deposit • Administrative complexity and cost
Manufacturer-Paid Recycling Fund	• Administrative complexity • Difficulty allocating costs equitably among manufacturers • Certainty of resistance from manufacturers
Manufacturer-Paid and Administered Recycling Program	• Difficulty allocating responsibility among manufacturers • Certainty of resistance from manufacturers • Probable high cost (Difficult to gain economies possible if electronics recycling is integrated with other existing recycling programs)
Manufacturer Incentive	• Difficult to provide incentive to manufacturers who have no operations in Iowa • Administrative complexity • Reduces funds available for other programs

Unfortunately, Iowa cannot look elsewhere for successful examples of statewide policy to promote and finance electronics recycling. Only one state, Massachusetts, has mandatory statewide electronics recycling, and this is for only a single waste item, namely computer monitors. But Massachusetts is not comparable to Iowa for several reasons, including its much smaller geographic area, more concentrated population, smaller number of municipalities, better developed electronics recycling industry, several

precedents banning the disposal of other recyclable commodities, and a more readily identifiable funding source (unredeemed container deposits, which in Massachusetts revert to the state). If Iowa chooses to address the issue of electronics recycling through new statewide initiatives, it will be breaking new ground both in policy and implementation. We believe the options outlined in this Section offer the greatest hope and opportunity to successfully address the challenges of statewide electronics recycling in Iowa, but the State should be well aware that the challenges are not insignificant, the successful examples to build upon are nonexistent, and the foreseeable resistance to new and progressive policies, from many quarters, will be great.

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The following individuals provided information used in this analysis in interviews and in some cases through printed proprietary information:

Brothersen, Darrel, Rockwell Collins
Cretors, David, Iowa Department of Economic Development
Dietz, Cindy, Rockwell Collins
Geerts, Jeff, Iowa Department of Natural Resources
Holtz, Brian, City Carton Company
Johnson, Dewayne, Iowa Recycling Association
Klawiter, Barbara, REACT Center
Long, David, Midwest Computer Brokers
McKeen, Marlyn, Goodwill Industries (Des Moines)
Ockenfels, John, City Carton Company
Preston, Shawn, Iowa Prison Industries
Rankin, Merry, Iowa Department of Natural Resources
Reed, Doug, Iowa Department of General Services
Rogge, Mary Kay, Iowa Department of Transportation
Schonts, Beth, Des Moines Metro Waste Authority
Sloop, William, Bluestem Solid Waste Agency
Watson, John, Goodwill Industries (Iowa City)
Woelfel, Johanna, Iowa Department of Economic Development
Young, Larry, A-Tec Recycling

APPENDIX A

IOWA COMPANIES AND INSTITUTIONS RESPONDING TO WUF TECHNOLOGIES SURVEY ON CEE MANAGEMENT

Iowa Companies Responding to Wuf Technologies Survey on CEE Management

3M
Advanced Network Technologies
Aegon USA
Alcoa
Amana Appliances
APAC Insurance
Bankers Trust Company
BankIowa
Barilla America, Inc.
Beecher, Field, Walker, Morris (Attorneys)
Black Hawk Broadcasting
Cisco Systems
Community National Bank
F&M Bank
Farm Credit Services of America
First American Bank
Firstar Bank
GE Capital - Financial Services
John Deere (Des Moines Works)
McLeod USA
Midland Bioproducts Corp.
Oscar Meyer
Pioneer Hi-Bred International, Inc.
Principal Financial
Pulley & Associates
Roche Vitamins
Rockwell Collins
Struxture Architects
The Learning Company
Trans-Lux Midwest
Universal Harvester, Inc.

Iowa Institutions Responding to Wuf Technologies Survey on CEE Management

Allen College
Allen Memorial Hospital
Cedar Rapids Community School District
Clinton Community College
Genesis Medical Center West Campus
Hawkeye Community College
Iowa Health System
Iowa State University
Mercy Hospital
Mercy Medical Center
University of Iowa
University of Northern Iowa
Waldorf College
Waterloo Community Schools

APPENDIX B

COMPUTER AND ELECTRONIC EQUIPMENT RECYCLING IMPLEMENTATION OPTIONS

CEE RECYCLING IMPLEMENTATION OPTION
LOCAL RECYCLING PROGRAMS (DROPOFF CENTERS)

DESCRIPTION

- Over 365 Iowa communities have dropoff locations for some or all recycled materials. These sites are known to and already used residents of these communities, some 40-50% of Iowa residents.
- Collection trailer would be spotted at dropoff site. Residents and small businesses would bring used electronics to the dropoff location. (Alternatively, electronics could be collected and stored out of the weather, and loaded into a trailer making a run either to a single site [when a full trailer load is collected] or to multiple sites [”milk run” of less-than-truckload quantities].)
- Collection should be staffed (i.e., no unattended dropoff). Staffing necessary to maintain material specifications, sort if necessary (e.g., CRTs, CPUs, “other”) and to assure material is properly packaged for transportation.
- Collection could be full- or part-time (coinciding with regular dropoff hours) or “event day.”
- Trailer would be periodically pulled to recycling partner (see TRANSPORTATION OPTIONS)

ADVANTAGES	DISADVANTAGES
• Easiest option (shortest transport distance) for local residents in communities with dropoff site • Sites already established • Sites known to residents • Many/most sites already staffed with persons knowledgeable in collecting recyclables • Many/most sites already used to meeting specs, storing and shipping recyclable commodities	• A very large number of sites to track and manage. • Most sites are unstaffed; significant concern re illegal dumping and scavenging • Difficult and costly transportation because so many sites, with little volume per site • Could take a long time to fill a trailer at many locations (high cost to park empty trailer). (But trailer not necessarily a requirement — see alternative under “Description”) • Need forklift to load. Doubtful that forklifts are available at many dropoff locations. • Not universally applicable, because not all communities have dropoff location. Another model would be required in other communities. • Not clear that many sites have adequate staffing to handle electronics. Additional staff likely required. • Unknown if all or most sites have adequate space and facilities to collect and store CEE • Large number of communities and individual implies high administrative burden, difficult logistics, difficult education, communications, etc.

CEE RECYCLING IMPLEMENTATION OPTION
LOCAL SPRING CLEANUP DAYS

DESCRIPTION

- A large proportion of Iowa communities have 'spring cleanup days' where a wide variety of materials are brought in to be disposed or recycled.
- Residents and small businesses would bring used electronics to cleanup day location.
- Equipment would be sorted, prepared for transport (gaylords or pallets), and stored out of the weather prior to transportation.
- Collection should be staffed (i.e., no unattended dropoff). Staffing necessary to maintain material specifications, sort if necessary (e.g., CRTs, CPUs, "other") and to assure material is properly packaged for transportation.
- Recycling partner (or other transporter) would sweep materials from multiple sites (to assure truckload quantities for transportation) at close of spring cleanup "season".

ADVANTAGES	DISADVANTAGES
• Builds on existing program known and implemented in a large proportion of Iowa communities, and familiar to a large proportion of residents • Cleanup days already staffed. Probably wouldn't need to add staff to handle CEE. • Could build on existing publicity	• Lots and lots of stuff collected in a very short period. Presuming most communities schedule these days in a few weeks in the spring. Would entail a tremendous short-term demand for trailers and transportation. • Large number of communities and individual programs implies high administrative burden, difficult logistics, difficult education, communications, etc. • Expensive transportation to collect a small quantity of equipment from each of a large number of communities. • Needs research to confirm the N of communities with cleanup days. If not as widespread as believed, the option becomes unworkable as a statewide alternative (because not available to enough of population).

CEE RECYCLING IMPLEMENTATION OPTION
LOCAL/REGIONAL RECYCLING CENTERS

DESCRIPTION

- A network of 110+/- recycling centers exists around Iowa. These are establishment where one or more recyclables are collected and processed prior to marketing. About half are private, half public, although the majority of tonnage goes through the private facilities. Some process multiple materials, some only one (particularly paper). In some cases, recycling centers act as dropoff locations for local residents, in others not. Most perform some amount of processing and sorting.
- Electronics collection would be implemented at a subset of these centers, selected to provide statewide geographic coverage and according to cooperation offered by their operators.
- Collection trailer would be spotted at the recycling center. Residents and small businesses bring used electronics to the center. (Alternatively, electronics could be collected and stored out of the weather, and loaded into a trailer making a run either to a single site [when a full trailer load is collected] or to multiple sites [”milk run” of less-than-truckload quantities].)
- Collection could be full-time (open during all RRC hours), part-time (coinciding with all or a subset of RRC hours), or “event-day.”
- Collection should be staffed (i.e., no unattended dropoff). Staffing necessary to maintain material specifications, sort if necessary (e.g., CRTs, CPUs, “other”) and to assure material is properly packaged for transportation. Staff could be drawn from RRC staff, landfill staff (if RRC located at landfill), recycling partner staff (if “event day” model), or other.
- Electronics collection could be full time (all hours when recycling center open), part-time (a prescribed subset of recycling center hours), or “event day”.
- Trailer would be periodically pulled to recycling partner, or trailer would arrive to be loaded with equipment collected and stored on site (see TRANSPORTATION OPTIONS)

ADVANTAGES	DISADVANTAGES
• Takes advantage of existing network of facilities already dedicated to recycling • Recycling center staff used to sorting, handling and storage procedures for recyclables, need to meet specifications, etc. • Residents in many locations already bring recyclables to recycling centers • Amenable to implementation as a pilot program with one or a few centers • Many centers likely to have adequate storage space for electronics. All have adequate space to handle trailers for transportation. • Could be adequate staff at many centers to handle electronics along with other materials (especially if CEE is handled through part-time or event day collection)	• Requirement to gain cooperation from many disparate partners, public and private • Not all recycling centers serve as dropoff locations. Research required to assure that adequate statewide coverage is provided. • Likely that dedicated staff would be required to receive and handle electronics. Who will provide and pay for this staff? • Doubtful that centers have excess storage capacity for CEE. Would have to spot trailers ($$$), or build weather-protected storage ($$$). • Unclear that all centers have forklifts or other means to load for transportation.

CEE RECYCLING IMPLEMENTATION OPTION
REGIONAL (HHW) COLLECTION CENTERS

DESCRIPTION

- Network of 15 permanent collection sites (secure, fenced locations) plus 16 satellite sites is already set up to handle household hazardous wastes. RRCs are staffed full- or part-time depending on the district, and are set up to handle returns of hazardous commodities.
- Collection trailer would be spotted at RRC. Residents and small businesses bring used electronics to RRC location. (Alternatively, electronics could be collected and stored out of the weather, and loaded into a trailer making a run either to a single site [when a full trailer load is collected] or to multiple sites ["milk run" of less-than-truckload quantities].)
- Collection could be full-time (open during all RRC hours), part-time (coinciding with all or a subset of RRC hours), or "event-day."
- Collection should be staffed (i.e., no unattended dropoff). Staffing necessary to maintain material specifications, sort if necessary (e.g., CRTs, CPUs, "other") and to assure material is properly packaged for transportation. Staff could be drawn from RRC staff, landfill staff (if RRC located at landfill), recycling partner staff (if "event day" model), or other.
- Trailer would be periodically pulled to recycling partner, or trailer would arrive and be loaded with equipment collected and stored on site (see TRANSPORTATION OPTIONS)

ADVANTAGES

- Takes advantage of existing network of sites
- Takes advantage of existing, publicized DNR program
- RRCs already staffed and secure
- Already scheduled permanent or periodic collection of "special" recyclables at these locations
- Some knowledge and habit on the part of many residents to take HHW to these locations, and knowledge of local schedules
- EZ add-on to publicity for HHW collection. EZ to characterize at least monitors and TVs as an HHW analogue
- HHW program already targeted to small business along with residents
- Although statewide coverage is incomplete, RRC network covers all major metro areas, 56 of 99 counties, and most of state population
- Possible to add CEE to toxic cleanup days for counties not covered by RCCs
- Builds on existing relationships and agreements among counties
- Limited number of sites simplifies administration, logistics, communications, education, etc. Reduces likelihood of problems and makes them more manageable.

DISADVANTAGES

- Unclear that current RRC staff (number and skills) are adequate to handle additional responsibilities associated with CEE collection
- Need a forklift at each site to get equipment from ground into trailer. If not trailer, need some other secure, out-of-weather facility to hold CEE prior to transport.
- Spotting a trailer at each site quite expensive (but trailer not necessarily a requirement — see "Description" for alternative)
- State coverage is incomplete. Only 15 RRCs statewide (plus 16 satellites). Long transportation distance for some residents to nearest RRC. Have to do "something else" for counties served only by toxic cleanup days.

CEE RECYCLING IMPLEMENTATION OPTION
IOWA DOT GARAGES

DESCRIPTION

- IDOT has a network of over 70 supervisory garages and about 30 satellite garages (secure locations) throughout the state.
- Collection trailer would be spotted at selected garage sites (all or a subset of possible locations). Residents and small businesses would bring used electronics to the garage location. (Alternatively, electronics could be collected and stored out of the weather, and loaded into a trailer making a run either to a single site [when a full trailer load is collected] or to multiple sites [”milk run” of less-than-truckload quantities].)
- Collection should be staffed (i.e., no unattended dropoff). Staffing necessary to maintain material specifications, sort if necessary (e.g., CRTs, CPUs, “other”) and to assure material is properly packaged for transportation. Staff could be drawn from RRC staff, landfill staff (if RRC located at landfill), recycling partner staff (if “event day” model), or other.
- Collection could be part-time or “event day.” (Hard to envision full-time staffing at such locations)
- Trailer would be periodically pulled to recycling partner

ADVANTAGES	DISADVANTAGES
• Excellent statewide coverage • Sites are already established and secure • Sites already under state control • Limited number of sites simplifies administration, logistics, communications, education, etc. Reduces likelihood of problems and makes them more manageable.	• State highway garage locations generally not known to residents • State highway locations not necessarily planned to be convenient • Need a forklift at each site to get equipment from ground into trailer. • Spotting a trailer at each site quite expensive (but trailer not necessarily a requirement — see “Description” for alternative). If not trailer, would need another kind of out-of-weather storage capability. • Would require commitment of staff from some source (state, planning districts...) • Coordination with IDOT — simple or difficult?

CEE RECYCLING IMPLEMENTATION OPTION
BEST BUY RETURN PROGRAM

DESCRIPTION

- Best Buy, an electronics retailer, has initiated a pilot program to collect and recycle used electronics.
- Recycling events are scheduled at individual stores, typically two days over a weekend. Residents bring used equipment to the Best Buy location, where it is sorted and packaged for transport by a recycling partner engaged by Best Buy. These have been local or regional recyclers.
- The material specification has included anything computer-related, plus faxes, TVs, stereo equipment, camcorders, VCRs, cell phones, etc.
- Depending on local sponsorship, some events have taken all equipment at no charge, some have charged for monitors and TVs
- Recycling partner transports collected equipment to recycling facility and recycles as appropriate
- Have been about ½ dozen events since the program was announced in April. Unclear whether, when, and how Best Buy will translate into a national program.

ADVANTAGES	DISADVANTAGES
• Best Buy has coordinated all logistics • Best Buy has handled all publicity • Best Buy handles all administration • Best Buy has made most financial commitments (although recycling charge for CRTs has been eliminated through local $$ sponsorship) • Part of an ongoing program. Little Iowa initiative required • Best Buy has stated its commitment to a national program • Iowa already pencilled in to take part in this program (per Merry)	• This is currently a pilot program only. Unclear that it will be rolled out nationally, and over what time frame if so. • No Iowa location is planned by Best Buy for a pilot event • There are only five Best Buy locations in Iowa: Des Moines (2); Cedar Rapids; Davenport; and Coralville (Iowa City) (plus 2 in Omaha and one in Sioux Falls, SD). Although potentially suitable for a pilot, this coverage is inadequate for a statewide program. • Not targeted at small businesses • Cost structure unclear. If BB imposes cost to residents, participation rate likely to drop dramatically (or subsidy would be required to bring cost to generator back to $0.00).

CEE RECYCLING IMPLEMENTATION OPTION ANOTHER RETAILER OR RETAILERS	
DESCRIPTION • Involve another retail chain or chains in a return program similar to Best Buy's • Consumers bring equipment to collection events at retail location • CEE is transferred into trailers at each location, then taken to recycling partner. CEE could be loaded into trailer during recycling event, or stored on site and then loaded into trailer making a milk run collection. • Potential enticement through rebates, discounts, or other $$ value for participation	
ADVANTAGES • Builds on existing consumer habits and travel patterns. • Links return of used equipment to purchase of new equipment • Possible to link to rebates, discounts, or other financial rewards to induce consumers to participate (but who would finance?) • Consistent with Advance Disposal Fee funding mechanism	**DISADVANTAGES** • Need to involve multiple partners. Outside of Best Buy, none has stepped forward with interest in a program like this. • Need to coordinate multiple private sector partners. Not an easy chore. • Need to ID enough partners to assure statewide coverage. Not an easy chore. (Not necessary for pilot program, but then would make it more difficult and less certain of success to expand pilot into a statewide program) • Need to supply staff to collect, sort, and package equipment for transport. Whose staff? • Need for forklift on site to load trailers. Whose forklift?

CEE RECYCLING IMPLEMENTATION OPTION CONSUMER MAIL-BACK	
DESCRIPTION • Consumer packages used equipment and ships to designated recycling facility • Packaging may be supplied by consumer, or may be supplied by recycling authority (local recycling program, public or private sector partner, etc.) • Shipping charges could be paid by consumer, or could be paid by state or other entity • Recycling cost could be paid by consumer, or could be paid by state or other entity as part of recycling program • Consumer could be required to take packaged equipment to shipping location (e.g., UPS shipping point), or shipper could be engaged to pick up at consumer location (home or business)	
ADVANTAGES • Recycling at a time and place convenient to consumer • Consistent with existing programs operated by IBM, Hewlett-Packard, and Compaq • Does not require state or other party to set up collection infrastructure • Universal coverage — available to all residents and small businesses	**DISADVANTAGES** • Shipping requirement adds significant cost to recycling • Inconvenient to consumers (requirement to pack and ship, possibly to provide packaging, possibly to return equipment to shipping location) • Not applicable to large equipment like televisions • Very complex to set up and administer

APPENDIX C

COMPUTER AND ELECTRONIC EQUIPMENT RECYCLING FUNDING OPTIONS

OPTION 1	**CAPTURE SALES TAX REVENUES TO FUND CEE RECYCLING**
SCENARIO A	**RECYCLING FUNDS BASED LINKED DIRECTLY TO CEE PURCHASES REPORTED BY RETAILERS AND OTHER VENDORS**
Summary	Retailers and others who sell CEE are required to segregate and report $$ volume of CEE sales as part of sales/use tax return. Sales/use tax dollars generated by CEE sales are used to fund CEE recycling.
Implementation	STATE identifies categories of CEE to generate revenues for CEE recycling. These could include software, games, CDs, or other accessory purchases in addition to CEE hardware.
	RETAILERS who sell CEE in these categories are required to report $$ sales volumes of these products (in sales/use tax returns)
	From tax returns, STATE calculates sales/use tax $$ generated from sales in target CEE categories
	STATE diverts this $$ amount from general fund to dedicated CEE recycling fund
Issues	Requires affected retailers to track and report $$ purchases in specified CEE product categories. Currently, they are required to report only gross sales of taxable items.
	Most retailers have inventory control procedures that track goods sold by item. Adding a process to associate tax with these sales should not pose an insuperable burden.
	If sales tax $$ less than required recycling fund, have to supplement (expand N of product categories generating tax for CEE recycling, take $$ from other sources)
	If sales tax $$ more than required recycling fund, have to dispose of surplus (reduce N of product categories generating tax for CEE recycling, specify proportion of relevant sales tax $$ earmarked for CEE recycling, relinquish $$ to general fund)
Advantages	Direct, uncomplicated
	No additional tax perceived by Iowans
	Uses tax calculation and collection system already in place, already accepted by Iowans and Iowa businesses
	Nearly all retailers have inventory tracking software capable of tracking and reporting sales and calculating related tax
	Allows payment for CEE recycling to be spread over related items purchased, not only CEE hardware
Disadvantages	Additional reporting required from retailers
	Assuring collections from out-of-state vendors (particularly internet and catalog sales, where vendors do not have a physical presence in Iowa)
	Taxing internet sales may contravene federal law
	Reduces tax receipts available for other state programs. Unlikely to garner legislative support in light of unfavorable economic and tax climate
	Possibility (likelihood) that recycling funds would be “parasitized” to fund other state programs
	No manufacturer responsibility — entire CEE recycling cost borne by consumers (and state for administration)

Resistance From:	Iowa legislature:	Certain	Iowa agencies:	Probable
	Manufacturers:	Unlikely	Retailers:	Probable
	Consumers:	Unlikely		

OPTION 1B CAPTURE SALES TAX REVENUES TO FUND CEE RECYCLING

SCENARIO B RECYCLING FUNDS BASED ON STATE ESTIMATES OF CEE PURCHASES

Summary	State estimates the $$ amount of sales tax revenue associated with CEE sales, by estimating the $$ volume of CEE sold in Iowa. This sales tax revenue is diverted into dedicated CEE recycling fund.
Implementation	STATE identifies categories of CEE to generate revenues for CEE recycling fund. These could include software, games, CDs, or other accessory purchases in addition to CEE hardware.
	STATE periodically conducts and/or updates a study to estimate the $$ volume of these product categories sold in Iowa.
	STATE uses this study to estimate the $$ of sales/use tax collected from purchases of targeted CEE categories
	STATE diverts this $$ amount from general fund to dedicated CEE recycling fund
Issues	If sales tax $$ less than required recycling fund, have to supplement (expand N of product categories generating tax for CEE recycling, take $$ from other sources)
	If sales tax $$ more than required recycling fund, have to dispose of surplus (reduce N of product categories generating tax for CEE recycling, specify proportion of relevant sales tax $$ earmarked for CEE recycling, relinquish $$ to general fund)
Advantages	No additional tax perceived by Iowans
	Uses tax collection system already in place, already accepted by Iowans and Iowa businesses
	Consistent with current sales/use tax reporting. Does not require retailers to track and report sales of specific items. No additional reporting required.
	Allows payment for CEE recycling to be spread over related items purchased, not only CEE hardware.
	Compared to Option 1A, out-of-state and internet sales are less of an issue.
Disadvantages	Does not resolve issue that out-of-state vendors and internet sales escape taxation
	Requires initial preparation and subsequent update of study analyzing Iowa sales of a wide variety of CEE and CEE-related products.
	Reduces tax receipts available for other state programs. Unlikely to garner legislative support in light of unfavorable economic and tax climate
	Possibility (likelihood) that recycling funds would be "parasitized" to fund other state programs
	No manufacturer responsibility — entire CEE recycling cost borne by consumers (and state for administration)

Resistance From:	Iowa legislature:	Certain	Iowa agencies:	Probable
	Manufacturers:	Unlikely	Retailers:	Unlikely
	Consumers:	Unlikely		

OPTION 2	**CREATE A CEE RECYCLING FUND FROM CURRENT LANDFILL TONNAGE SURCHARGES**
Summary	State sequesters funds from landfill surcharges into a dedicated CEE recycling fund
Implementation	STATE calculates $$ required to fund CEE recycling
	Based on reported landfill disposal tonnage, STATE calculates $$/ton of waste disposed required to fund CEE recycling
	STATE diverts required $$/ton from landfill disposal fees into CEE recycling fund
Advantages	Direct, uncomplicated
	This funding source already exists, is directly related to a metric of waste generation, and is already earmarked for waste-related expenditures
	No additional tax perceived by Iowans
	Uses tax collection system already in place, already accepted by Iowans
Disadvantages	Landfill tax already spoken for by multiple claimants. Attempting to divert a sizeable proportion for CEE recycling would generate significant resistance, from both municipalities and LF districts, and from state programs now receiving LF tonnage funds.
	Potential parasitism
	Reduces tax receipts available for other state programs. Unlikely to garner legislative support in light of unfavorable economic and tax climate
	No manufacturer responsibility — entire CEE recycling cost borne by consumers (and state for administration)

Resistance From:	Iowa legislature:	Certain	Iowa agencies:	Probable (Certain from munis and waste districts)
	Manufacturers:	Unlikely	Retailers:	Unlikely
	Consumers:	Unlikely		

OPTION 3	**CREATE A CEE RECYCLING FUND FROM OTHER STATE REVENUES**			
Summary	Fund CEE recycling from general funds generated from multiple sources (unrelated to waste generation or management)			
Implementation	STATE calculates cost of statewide CEE recycling program			
	STATE includes funding for CEE recycling in annual state appropriation legislation			
Advantages	Direct, uncomplicated option			
	No additional tax perceived by Iowans			
	Uses tax calculation and collection system already in place, already accepted by Iowans			
	No additional state administration required			
Disadvantages	Reduces tax receipts available for other state programs. Unlikely to garner legislative support in light of unfavorable economic and tax climate			
	Subject to annual legislative whim — funding could be eliminated at almost any time.			
	No manufacturer responsibility — entire CEE recycling cost borne by consumers (and state for administration)			
Resistance From:	Iowa legislature:	Certain	Iowa agencies:	Probable
	Manufacturers:	Unlikely	Retailers:	Unlikely
	Consumers:	Unlikely		

OPTION 4	**IMPLEMENT A CONSUMER-PAID "ADVANCE DISPOSAL FEE"**
SCENARIO A	**NO COMPENSATION TO CONSUMER**
Summary	Consumer pays a fee at the time of CEE purchase which is used to fund CEE recycling
Implementation	STATE IDs categories of CEE to generate funds for CEE recycling. These could include software, games, CDs, or other accessory purchases in addition to CEE hardware.
	STATE studies and calculates Iowa sales $$ of these product categories
	STATE calculates ADF associated with each purchase required to fund statewide CEE recycling. Calculation can be prepared to determine a specific $$ amount per item purchased, or ADF as % of purchase price.
	CONSUMER pays ADF to VENDOR when CEE is purchased.
	VENDOR tracks CEE purchases, and remits ADF to state (totally analogous to sales/use tax remission).
Issues	Requires affected retailers to track and report purchases in specified CEE product categories. Currently, they are required to report only gross sales of taxable items. BUT, most retailers have inventory control procedures that track goods sold by item. Adding a process to associate tax with these sales should not pose an insuperable burden.
Advantages	Direct, uncomplicated
	Imposition and administration consistent with current sales/use tax implementation. Would not require significant additional administration. Tax calculation and collection system already in place, already accepted by Iowa businesses
	Nearly all retailers have inventory tracking software capable of tracking and reporting sales and calculating related tax
	Allows payment for CEE recycling to be spread over related items purchased, not only CEE hardware
	CEE recycling $$ linked directly to CEE purchases.
	Working precedents for tires, batteries
Disadvantages	An additional sales tax, however disguised.
	Potentially complex to administer. Dozens of product categories to track and assign to ADF program. Thousands of annual tax returns and $$ payments to review and administer.
	Additional paperwork and money to be handled by vendors.
	Legal and practical difficulties in handling ADF levied on out-of-state vendors.
	Potential parasitism of ADF funds
	Consumer bears burden of paying for recycling. Retailers and state bear burden of administering the program. Manufacturers pay and do nothing.
	Taxing internet sales may contravene federal law

Resistance From:	Iowa legislature:	Probable	Iowa agencies:	Uncertain
	Manufacturers:	Unlikely	Retailers:	Probable
	Consumers:	Probable		

OPTION 4	**IMPLEMENT A CONSUMER-PAID "ADVANCE DISPOSAL FEE"**
SCENARIO B	**NO COMPENSATION TO CONSUMER; MANUFACTURER MATCH**
Summary	Consumer pays a fee at the time of CEE purchase which is used to fund CEE recycling. Manufacturer matches consumer ADF payment.
Implementation	STATE IDs categories of CEE to generate funds for CEE recycling. These could include software, games, CDs, or other accessory purchases in addition to CEE hardware.
	STATE studies and calculates Iowa sales $$ of these product categories
	STATE calculates ADF associated with each purchase required to fund statewide CEE recycling. Calculation can be prepared to determine a specific $$ amount per item purchased, or ADF as % of purchase price.
	CONSUMER pays ADF to VENDOR when CEE is purchased.
	VENDOR tracks CEE purchases, and remits ADF to state (totally analogous to sales/use tax remission).
	STATE tracks CEE sales by manufacturer.
	STATE periodically invoices manufacturers for an ADF matching payment based on manufacturer sales. (Manufacturer match could be equal to, greater than, or less than consumer ADF payment.)
	MANUFACTURERS remit ADF matching payments to STATE
Issues	Requires affected retailers to track and report purchases in specified CEE product categories. Currently, they are required to report only gross sales of taxable items. BUT, most retailers have inventory control procedures that track goods sold by item. Adding a process to associate tax with these sales should not pose an insuperable burden.
	Requires state to track sales by manufacturer and item, and administer manufacturer match
Advantages	Imposition and administration consistent with current sales/use tax implementation. Tax calculation and collection system already in place, already accepted by Iowa businesses
	Nearly all retailers have inventory tracking software capable of tracking and reporting sales and calculating related tax
	Allows payment for CEE recycling to be spread over related items purchased, not only CEE hardware
	CEE recycling $$ linked directly to CEE purchases.
	Working precedents for tires, batteries
	"Shared financial responsibility" between consumers and manufacturers
Disadvantages	An additional sales tax, however disguised.
	Potentially complex to administer. Dozens of product categories to track and assign to ADF program. Thousands of annual tax returns and $$ payments to review and administer.
	Additional paperwork and money to be handled by vendors.
	Additional state administrative burden to track sales by manufacturer, invoice manufactures according to sales, and handle manufacturer ADF match payments.
	Legal and practical difficulties in handling ADF levied on out-of-state vendors.

	Potential parasitism of ADF funds			
	Taxing internet sales may contravene federal law			
Resistance From:	Iowa legislature:	Probable	Iowa agencies:	Uncertain
	Manufacturers:	Probable	Retailers:	Probable
	Consumers:	Probable		

OPTION 4 **IMPLEMENT A CONSUMER-PAID "ADVANCE DISPOSAL FEE"**

SCENARIO C **REQUIRE MANUFACTURERS TO PROVIDE CONSUMERS A CASH REBATE EQUAL TO (OR GREATER THAN) THE ADF**

Summary	Consumer pays a fee at the time of CEE purchase to fund CEE recycling. Consumer subsequently provides proof of purchase to manufacturer. Manufacturer sends consumer a cash rebate equal to ADF.
Implementation	STATE IDs categories of CEE to generate funds for CEE recycling.
	STATE studies and calculates Iowa sales $$ of these product categories
	STATE calculates ADF associated with each purchase required to fund statewide CEE recycling. This calculation can be carried out to determine a specific $$ amount per item purchased, or ADF as % of purchase price.
	CONSUMER pays ADF to VENDOR when CEE is purchased.
	VENDOR tracks CEE purchases, and remits ADF to state (totally analogous to sales/use tax remission).
	After paying ADF, CONSUMER provides proof of purchase and ADF payment to manufacturer of equipment (or other ADF item) purchased
	MANUFACTURER remits to consumer a cash rebate equal to ADF.
Advantages	Consumer compensated for ADF payment.
	Ultimate payment for ADF is borne by manufacturer
	Uses tax calculation and collection system already in place, already accepted by Iowans and Iowa businesses
	Partial working precedents for tires, batteries
	Nearly all retailers have inventory tracking software capable of tracking and reporting sales and calculating related tax
Disadvantages	Complex. Two transactions to manage for each item recycled.
	Doubles total administrative burden.
	Limits manufacturer participants to hardware producers. Questionable that these are the only firms who should be responsible for shouldering burden of financing CEE recycling.
	Potentially complex to administer. Dozens of product categories to track and assign to ADF program. Thousands of annual tax returns and $$ payments to review and administer.
	Additional paperwork and money to be handled by vendors.
	Legal and practical difficulties in handling ADF levied on out-of-state vendors.
	Potential parasitism of ADF funds
	Taxing internet sales may contravene federal law

Resistance From:	Iowa legislature:	Uncertain	Iowa agencies:	Unlikely
	Manufacturers:	Certain	Retailers:	Probable
	Consumers:	Uncertain		

OPTION 4 **IMPLEMENT A CONSUMER-PAID "ADVANCE DISPOSAL FEE"**

SCENARIO D **REQUIRE MANUFACTURERS TO PROVIDE CONSUMERS A MERCHANDISE REBATE EQUAL TO (OR GREATER THAN) THE ADF**

Summary	Consumer pays a fee at the time of CEE purchase to fund CEE recycling. Consumer subsequently provides proof of purchase to manufacturer. Manufacturer provides consumer with a merchandise rebate equal to (or greater than) ADF.
Implementation	STATE IDs categories of CEE to generate funds for CEE recycling. These could include software, games, CDs, or other accessory purchases in addition to CEE hardware.
	STATE studies and calculates Iowa sales $$ of these product categories
	STATE calculates ADF associated with each purchase required to fund statewide CEE recycling. Calculation can be prepared to determine a specific $$ amount per item purchased, or ADF as % of purchase price.
	CONSUMER pays ADF to VENDOR when CEE is purchased.
	VENDOR tracks CEE purchases, and remits ADF to state (totally analogous to sales/use tax remission).
	After paying ADF, CONSUMER provides proof of purchase and ADF payment to manufacturer of equipment (or other ADF item) purchased
	MANUFACTURER provides consumer with credit toward a future purchase, in an amount equal to or greater than ADF.
Notes	Could be a voluntary program for manufacturers. If benefits to manufacturers of customer acquisition/retention would outweigh their cost to provide rebates, then they could be expected to participate in the rebate program on a voluntary basis. Forestalling more hard-nosed regulation would be an additional incentive for manufacturers to participate.
	Rebate program could generate additional $$ value available to manufacturers (or state) in consumer market data.
	Multiple manufacturers could manage the rebate program through the web. Consumers could select and purchase rebated products through a web site, or could identify products with rebate opportunities through the common web site, and then be directed to individual firms' web sites to complete purchases.
	Possible to bring in a private 3rd party to administer, reducing state cost and complexity.
Advantages	Consumer compensated for ADF payment.
	Manufacturers have incentive to participate because (1) merchandise rebate is not a direct cash payment, (2) offering rebate provides sales/marketing opportunities to reach new customers or retain existing customers.
	Uses tax calculation and collection system already in place, already accepted by Iowans and Iowa businesses
	Nearly all retailers have inventory tracking software capable of tracking and reporting sales and calculating related tax

Advantages (ctd)	Cost of recycling can be spread among manufacturers of software, games, disks, etc., and not HW manufacturers alone. Reduces burden to individual manufacturers, and appropriately assigns cost to products whose use is the primary reason for CEE purchase (i.e., you don't buy a computer to have a computer, you buy a computer to run software, so software manufacturers should share in the cost of CEE recycling.)			
	Partial working precedents for tires, batteries			
Disadvantages	Complex. Two transactions to manage for each item recycled.			
	Dual administrative burden — on state (ADF) and manufacturers (rebates)			
	Potentially complex to administer. Dozens of product categories to track and assign to ADF program. Thousands of $$ payments to review and administer.			
	Additional paperwork and money to be handled by vendors.			
	Legal and practical difficulties in handling ADF levied on out-of-state vendors.			
	Difficult to guarantee that "dedicated" recycling funds remain dedicated. Numerous examples exist of legislative parasitism of "dedicated" funds.			
	Taxing internet sales may contravene federal law			
Resistance From:	Iowa legislature:	Uncertain	Iowa agencies:	Unlikely
	Manufacturers:	Certain	Retailers:	Probable
	Consumers:	Uncertain		

OPTION 5	**IMPLEMENT A CONSUMER PAID RECYCLING FEE**
SCENARIO A	**NO COMPENSATION TO CONSUMER**
Summary	Consumer returns surplus CEE to a recycling location, and pays the cost to have the equipment recycled.
Implementation	STATE sets up statewide CEE recycling infrastructure, available to all residents (and small businesses).
	CONSUMER returns surplus CEE to recycling program.
	CONSUMER pays fee to cover the cost of recycling the returned CEE.
Advantages	Simplest of all options
	Easy administration for state (essentially eliminates state administrative role)
	Direct link between recycling and payment for recycling
Disadvantages	CEE recycling would need to be mandated by legislation. Otherwise, consumers have no incentive to participate. (Historically, CEE recycling rates approximate zero if consumer is voluntarily required to take on cost of recycling.)
	Even if recycling were made mandatory, this option would likely generate the lowest levels of participation and the lowest recycling rates of all options outlined.
	Low participation and capture rates imply high per-ton recycling cost (fixed cost to set up and manage recycling program spread over small tonnage recovered)
	No manufacturer responsibility — entire CEE recycling cost borne by consumers

Resistance From:	Iowa legislature:	Probable	Iowa agencies:	Uncertain
	Manufacturers:	Unlikely	Retailers:	Probable
	Consumers:	Probable		

OPTION 5B IMPLEMENT A CONSUMER PAID RECYCLING FEE

SCENARIO B REQUIRE MANUFACTURERS TO PROVIDE CONSUMERS A CASH REBATE EQUAL TO THE RECYCLING FEE

Summary	Consumer returns surplus CEE to a recycling location, and pays the cost to have the equipment recycled. Consumer provides proof of recycling and payment to manufacturer, and manufacturer sends consumer a cash rebate equal to the recycling charge.
Implementation	STATE sets up statewide CEE recycling infrastructure, available to all residents (and small businesses).
	CONSUMER returns surplus CEE to recycling program.
	CONSUMER pays fee to cover the cost of recycling the returned CEE.
	CONSUMER provides manufacturer of returned CEE with proof of recycling and payment of recycling fee
	MANUFACTURER remits to consumer a cash rebate equal to (or greater than) the recycling fee.
Advantages	Essentially eliminates state administrative role
	Direct link between recycling and payment for recycling
	Shifts burden of paying for recycling to manufacturers
Disadvantages	Complex. Two transactions to manage for each item recycled. Double transaction adds complexity for consumers. If manufacturers are ultimately going to reimburse cost of recycling, why not simply have them finance the program? Why introduce the added rebate transaction?
	Limits manufacturer participants to hardware producers. Questionable that these are the only firms who should be responsible for shouldering burden of financing CEE recycling.
	Consumer bears the initial recycling cost. Only if consumer follows through with rebate request does cost get shifted to manufacturer.
	Requirement that consumer make the initial recycling payment is disincentive to participate.
	What about old equipment from manufacturers no longer in existence.

Resistance From:	Iowa legislature:	Uncertain	Iowa agencies:	Unlikely
	Manufacturers:	Certain	Retailers:	Unlikely
	Consumers:	Uncertain		

OPTION 5 IMPLEMENT A CONSUMER PAID RECYCLING FEE

SCENARIO C REQUIRE MANUFACTURERS TO PROVIDE CONSUMERS A MERCHANDISE REBATE EQUAL TO (OR GREATER THAN) THE RECYCLING FEE.

Summary	Consumer returns surplus CEE to a recycling location, and pays the cost to have the equipment recycled. Consumer provides proof of recycling and payment to manufacturer, and manufacturer provides consumer with a merchandise rebate equal to (or greater than) the recycling fee.
Implementation	STATE sets up statewide CEE recycling infrastructure, available to all residents (and small businesses).
	CONSUMER returns surplus CEE to recycling program.
	CONSUMER pays fee to cover the cost of recycling the returned CEE.
	CONSUMER provides manufacturer with proof of recycling and payment of recycling fee. Participating manufacturers need not be limited to manufacturers of recycled CEE, but could be manufacturers of peripheral equipment, software, games, computer-related services, or others the state wishes to assume part of the cost of CEE recycling.
	MANUFACTURER provides consumer with credit toward a future purchase, in an amount equal to (or greater than) the recycling fee
Notes	Rebate program can be either paper (mail-in paper rebate) or electronic (consumer electronically credited with rebate amount, which can then be "cashed" in a web purchase)
	No necessary connection between item recycled or and item toward which rebate is purchased. For example, rebate generated from recycling of a monitor could be used to purchase new software.
	No necessary reason to limit firms offering rebates to the CEE industry. Any consumer product (or service) producer wishing to be associated with CEE recycling and attract/retain customers through the rebate program could be allowed to participate.
Advantages	Essentially eliminates state administrative role
	Direct link between recycling and payment for recycling
	Shifts burden of paying for recycling to manufacturers
	Cost of recycling can be spread among manufacturers of software, games, disks, etc., and not HW manufacturers alone. Reduces burden to individual manufacturers, and appropriately assigns cost to products whose use is the primary reason for CEE purchase (i.e., you don't buy a computer to have a computer, you buy a computer to run software, so software manufacturers should share in the cost of CEE recycling.)
	Manufacturers may see rebate program as marketing tool, encouraging their support and participation.
	Eliminates direct manufacturer financial link to recycling, nor a direct $$ cost, encouraging their support and participation

Disadvantages	Complex. Two transactions to manage for each item recycled. Double transaction adds complexity for consumers.			
	Consumer bears the initial recycling cost. Only if consumer follows through with rebate request does cost get shifted to manufacturer.			
	Requirement that consumer make the initial recycling payment is disincentive to participate.			
	Manufacturer financial responsibility for recycling is only indirect (merchandise).			
Resistance From:	Iowa legislature:	Uncertain	Iowa agencies:	Unlikely
	Manufacturers:	Certain	Retailers:	Unlikely
	Consumers:	Uncertain		

OPTION 6 IMPLEMENT A DEPOSIT-REFUND SYSTEM FOR CEE

Summary	Consumer pays a deposit when CEE is purchased. When CEE is recycled, the deposit is reimbursed, minus the cost of recycling the returned CEE.
Implementation	CONSUMER purchases an item of CEE, and pays a deposit at the time of purchase. The deposit is sufficient to cover the cost of recycling plus a fraction ultimately to be returned to the consumer. RETAILER remits deposits to the state. STATE sets up and manages a fund which pays for statewide recycling and from which redeemed deposits are repaid to consumers. At the "end of life" for the item of CEE, the
Advantages	Precedent established for cans and lead-acid batteries. Concept familiar to and well understood by consumers.
Disadvantages	Deposit systems are most effective if (1) deposit items are low cost (e.g., cans and bottles), and/or (2) deposit items have positive value (e.g., lead-acid batteries). Deposit systems have not been demonstrated effective for expensive, long-lived items with substantial costs to recycle, such as CEE A large backlog of used CEE exists, awaiting disposal. Difficult to envision handling this through a deposit-refund program. Another funding source likely required to pay for initial surge of recycling demand. How to deal with chain of ownership for long-lived equipment such as CEE. The person making the deposit loses its value if equipment is subsequently sold or given to another party. Because of substantial CEE recycling costs, most of the deposit will be needed to pay for recycling (plus program administration). If only a fraction of deposit is returned to the consumer, little incentive exists for the consumer to recycle (and the deposit program reverts essentially to an ADF). If much more of the deposit is returned to the consumer, then another funding source will have to be identified to fully fund recycling. Difficulty establishing who will be responsible for redeeming deposit, and potentially high administrative burden for redemption. Retailer redemption implies retailer takeback of used electronics. Redemption by local recycling programs implies substantial cash availability and complex claim system to state by programs. Indirect redemption (consumer recyclers, then submits proof of recycling to claim deposit) implies substantial state-managed redemption program. Near certainty of substantial resistance from retailers. Unlikely to gain consumer support if redemption value is less than deposit

Resistance From:	Iowa legislature:	Uncertain	Iowa agencies:	Unlikely
	Manufacturers:	Certain	Retailers:	Certain
	Consumers:	Uncertain		

OPTION 7 IMPLEMENT A MANUFACTURER-PAID DISPOSAL FEE

SCENARIO A MANUFACTURER PAYMENTS BASED ON IOWA SALES.

Summary	Manufacturers pay into a fund to support CEE recycling in Iowa, in amounts proportional to their sales of CEE in Iowa.
Implementation	STATE IDs categories of CEE to generate funds for CEE recycling. These could include software, CDs, computer-related services, or other accessory purchases in addition to CEE hardware.
	STATE studies and calculates sales $$ of these product categories in Iowa.
	STATE calculates disposal fee associated with each purchase which is required to fund statewide CEE recycling. This calculation can be carried out to determine a specific $$ amount per item purchased, or ADF as % of purchase price.
	VENDORS selling targeted CEE categories report sales by $$ amount and manufacturer
	STATE processes sales information, determines $$ owed by each manufacturer, and invoices manufacturers for the disposal fees associated with sales of targeted CEE items.
	MANUFACTURERS remit payments, which are deposited to CEE recycling fund
Notes	Either vendors or manufacturers could be required to report sales into Iowa. We believe vendors are the better reporting entity, because manufacturers typically don't know the ultimate fate of equipment sold into third-party distribution chains.
Advantages	$$ burden of paying for recycling borne by manufacturers, not consumers
	$$ burden could be spread among manufacturers of software, games, disks, etc., and not HW manufacturers alone. Reduces burden to individual manufacturers, and appropriately assigns cost to products whose use is the primary reason for CEE purchase (i.e., you don't buy a computer to have a computer, you buy a computer to run software, so software manufacturers should share in the cost of CEE recycling.)
Disadvantages	Complex to administer. State requirement to study CEE sales, estimate sales by product and manufacturer, levy and collect fees from manufacturers, and handle inevitable disputes.
	Practical and possibly legal difficulties in estimating sales into Iowa from out of state.
	Certainty of strong and organized resistance from manufacturers.
	Difficult to guarantee that "dedicated" recycling funds remain dedicated. Numerous examples exist of legislative parasitism of "dedicated" funds.

Resistance From:	Iowa legislature:	Uncertain	Iowa agencies:	Unlikely
	Manufacturers:	Certain	Retailers:	Unlikely
	Consumers:	Uncertain		

OPTION 7 IMPLEMENT A MANUFACTURER-PAID DISPOSAL FEE

SCENARIO B MANUFACTURER PAYMENTS BASED ON ANOTHER STATE-ESTABLISHED METRIC.

Summary	Manufacturers pay into a fund to support CEE recycling in Iowa. Amounts (which amount to a fee to do business in Iowa) are based on a determination made by the state but not directly linked to sales volume.
Implementation	STATE IDs categories of CEE to generate funds for CEE recycling. These could include software, CDs, computer-related services, or other accessory purchases in addition to CEE hardware.
	STATE calculates total size of recycling fund required to fund statewide CEE recycling.
	STATE identifies all manufacturers of targeted CEE categories
	STATE determines basis for calculating annual manufacturer payments into recycling fund (size of firm, toxicity of materials in goods sold, or other). STATE then assigns disposal fund payment to be invoiced to each manufacturer, and invoices.
	MANUFACTURERS remit payments, which are deposited to CEE recycling fund
Advantages	$$ burden of paying for recycling borne by manufacturers, not consumers
	$$ burden could be spread among manufacturers of software, games, disks, etc., and not HW manufacturers alone. Reduces burden to individual manufacturers, and appropriately assigns cost to products whose use is the primary reason for CEE purchase (i.e., you don't buy a computer to have a computer, you buy a computer to run software, so software manufacturers should share in the cost of CEE recycling.)
	Could be relatively simple to administer, if state identifies a simple, easily measured metric on which to base recycling payments
Disadvantages	Almost certain resistance from manufacturers
	Difficult to justify a basis for levying a recycling fee that is unrelated to CEE sales, environmental impacts of disposal, or another factor directly related to CEE use and disposition
	Could be complex to administer, if state identifies a complex metric on which to base recycling payments
	Basis for payment unrelated to CEE sales (or other direct link to CEE use and recycling) is subject to political manipulation
	Difficult to guarantee that "dedicated" recycling funds remain dedicated. Numerous examples exist of legislative parasitism of "dedicated" funds.

Resistance From:	Iowa legislature:	Uncertain	Iowa agencies:	Unlikely
	Manufacturers:	Certain	Retailers:	Unlikely
	Consumers:	Uncertain		

OPTION 8 REQUIRE MANUFACTURERS TO TAKE BACK AND PAY FOR RECYCLING OF TARGETED ITEMS OF CEE

Summary	Manufacturers required to establish and manage a program allowing consumers and small businesses to return surplus CEE for recycling
Implementation	STATE identifies CEE items targeted for recycling (because of environmental or other impacts associated with disposal). Presumably these would include at least CRTs, and maybe others.
	STATE crafts legislation requiring manufacturers who sell targeted items to set up, manage, and pay for recycling infrastructure allowing residents and small businesses in Iowa to return these items for recycling.
	MANUFACTURERS establish a recycling program available to all Iowa residents, and other generators specified by the state (e.g., small businesses), including manufacturer-borne funding mechanism.
	STATE retains oversight role to assure that program is available and convenient to all Iowans, verify that equipment is appropriately recycled, etc.).
Advantages	Simple for the state to enact and administer
	Manufacturers bear full responsibility for end-of-life CEE management — not only for paying for recycling, but for setting up and managing the statewide CEE recycling program
	Manufacturers have strong incentive to make CEE recycling as cost-effective as possible
	State can ascertain whether the recycling program is effective, and force manufacturers to improve the program if it is not
	A relatively small number of manufacturers involved
Disadvantages	How to deal with equipment from manufacturers other than those currently selling in Iowa (e.g., manufacturers no longer in business)
	Certainty of strong and organized resistance from manufacturers
	Manufacturers have strong incentive to make the CEE recycling program as inexpensive to them as possible — not necessarily the most widespread or effective. Possibility of long-term wrangling between state and manufacturers over program design and implementation.

Resistance From:	Iowa legislature:	Uncertain	Iowa agencies:	Unlikely
	Manufacturers:	Certain	Retailers:	Unlikely
	Consumers:	Uncertain		

OPTION 9 PROVIDE INDIRECT FINANCIAL INCENTIVES TO MANUFACTURERS TO ESTABLISH AND MANAGE A CEE RECYCLING PROGRAM

Summary	State requires manufacturers to establish and manage a CEE recycling program, and provides partial compensation in the form of tax or other incentives.
Implementation	STATE mandates manufacturers of electronic equipment to provide a mechanism for its recycling. STATE determines what items of CEE are to be covered, and what manufacturers are required to participate in funding and managing recycling. MANUFACTURERS identify and implement the most cost effective program they can to provide recycling opportunities to all state residents and small businesses. STATE retains an oversight role to assure the program is in fact effective and convenient to Iowa residents and small businesses. STATE provides financial payback to manufacturers required to participate in the program. Payback could be direct payment, sales tax forgiveness (encouraging increased sales), credits against other state liabilities, etc.
Advantages	Shifts burden of managing recycling to manufacturers Provides some incentive for manufacturers to lower their habituated resistance to accepting responsibility for managing and financing CEE recycling.
Disadvantages	Hard to envision meaningful tax or similar incentive (other than cash payment) to manufacturers who have few or no Iowa operations. Potentially complex to administer. Requires legislative mandate forcing manufacturers to establish recycling, coupled with legislative giveaway of tax revenue. Difficult combination.

Resistance From:	Iowa legislature:	Uncertain	Iowa agencies:	Unlikely
	Manufacturers:	Certain	Retailers:	Unlikely
	Consumers:	Uncertain		