



Used Electronics Market Study Survey Analysis

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Northeast Recycling Council, Inc. (NERC)
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Providers of Consumer Electronics Reuse Companies Lists

- Connecticut Department of Environmental Protection
- Delaware Department of Natural Resources & Environmental Control
- EPR2tm Project Electronic Equipment Recyclers Contact List
- Electronics Industries Alliance
- ElectronicsRecycling.net
- Empire State Development Environmental Management Services
- International Association of Electronic Recyclers
- Maine Department of Environmental Protection
- Maine State Planning Office
- Massachusetts Department of Environmental Protection
- National Recycling Coalition
- New Hampshire Department of Environmental Services
- New Jersey Department of Environmental Protection
- PEP National Directory of Computer Recycling Programs
- Pennsylvania Department of Environmental Services Unit
- Reuse Development Organization (REDo)
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- Used Computer Mall
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EXECUTIVE SUMMARY

I. INTRODUCTION

A. Overview

This analysis presents the results of the Used Electronics Market Study conducted by the Northeast Recycling Council, Inc. (NERC). The primary goal of the study was to better understand the market demand and economic viability of reused, remanufactured and repaired electronics, and to quantify the greenhouse gas emission savings of this activity. With the rapid rate of consumer electronics obsolescence, the growing momentum to ban electronics from landfills and the economic opportunity for reuse of these resource-rich discards, NERC was compelled to gather baseline information on this industry sector. The study results are based on surveys of reuse facilities serving the Northeast

B. Background

The project began with the development of a list of more than 100 non-profit and for-profit consumer electronics reuse facilities either located in or serving the Northeast. Working with an Advisory Committee, 70 entities were selected to be surveyed.ⁱ NERC staff telephoned electronic reuse facility managers to introduce the project and encouraged them to complete the survey, which was posted on line. As a result, there was a 49% response rate.

II. OVERVIEW OF RESPONDENTS

A. Respondents

Responses were received from facilities in eight states, including one from California. One-third of the respondents were non-profit organizations. See Table ES-1. Non-profit and for-profit electronic facilities were defined as businesses that:

Non-profit Organizations - take used electronics and either repair them and/or distribute them "as is" to schools or other institutions for little or no fee. In some cases, whole units may be sold or demanufactured.

For-profit Electronic Recycling Companies - are similar to other for-profit ventures. Their goal is to be financially successful.

An average of twenty-four percent of the respondents had more than one facility (22% of the for-profit companies and 27% of the non-profits). Overall, 70% of the additional facilities were located in the same state as the primary facility.

ⁱThe full survey is in Appendix 1.

Primary Facility Location	For-profit Companies	Non-profit Organizations	Total
CA	1	0	1
CT	3	1	4
MA	3	1	4
NH	3	2	5
NJ	2	1	3
NY	10	5	15
RI	1	0	1
VT	0	1	1
Total	23	11	34

B. Facilities

Non-profit Facilities Profile

The non-profit respondents have been in existence almost twice as long as the for-profit companies. See Table ES-2. They reported an average of 24 years in operation, with seven (7) full-time and six (6) part-time employees. Among these non-profits, whole unit electronics accounted for an average of 51% of gross sales and electronic components an average of 3% of gross sales. The respondents with 0% sales facilitated the free exchange of materials between donors and recipients. All of the electronics handled by the non-profits were reused.

For-profit Facilities Profile

The for-profit respondents averaged 14 years in operation, with 19 full-time employees, and six (6) part-time employees. They reported an average of 40% of gross sales from whole unit electronics and 29% of gross sales from electronic components.

Respondents	Years in Operationⁱⁱⁱ	# Full-time Employees^{iv}	# Part-time Employees	% Gross Sales Whole Unit Electronics	% Gross Sales Electronic Components
Non-profits	24	7	6	51%	3%
For-profits	14	19	10	40%	29%

Whole unit electronics were defined as intact CPUs, computer keyboards, monitors, & televisions; and electronic components as individual components of central processing units (CPUs), computer keyboards and monitors.

ⁱⁱⁱ The survey question asked for the total years in business, not just the numbers of years in the electronics reuse business.

^{iv} The survey referred to only those employees working in electronics reuse.

C. Operations

The survey asked each respondent to identify its operations by selecting all of the listed categories that apply to its operations. See Figure ES-1.

- ❑ **Asset Recovery**– Bids on surplus property from government and large companies. May remanufacture, demanufacture and/or sell units “as is”.
- ❑ **Repair Shop/Retailer** - Repairs used electronics for direct resale to consumers - generally small, family-run operations.
- ❑ **Remanufacturing** - Builds whole unit electronics from individual components, or rebuilds electronics for resale to consumers, retailers or brokers.
- ❑ **Demanufacturing** - Demanufactures used electronics for resale of individual components, and may sell workable whole units "as is" to brokers or retailers, or do nominal repair/remanufacture of whole units and then sell them to brokers or retailers.
- ❑ **Brokering** – Buys and sells whole unit electronics or individual components, or, in the case of non-profits, either sells materials or facilitates the free exchange of materials between donors and recipients.

Figure ES-1. Types of Operations

The for-profit sector was more diversified in its approach to managing electronics, with 43% of the companies relying on a mix of operations. Only 36% of the non-profits were similarly situated. Brokering is significantly more common in the non-profit sector than in the for-profit. See Table ES-3. Demanufacturing is approximately equal in frequency as an operation, but repair/retail and remanufacture are dramatically different. Asset recovery appears to be absent from the non-profit sector. Remanufacture and repair/retail go hand-in-hand in the non-profit sector.

Operation	For-profit	Non-profit
Asset Recovery	57%	0%
Brokering	43%	64%
Demanufacturing	52%	46%
Remanufacturing	9%	27%
Repair/Retail	13%	27%

D. Parts Used for Remanufacturing

All of the non-profit respondents that remanufacture electronics reported that they rely on both new and used parts, while 53% of the for-profit respondents employed both new and used parts, and 47% employed used parts only. See Table ES-4. The greater

utilization of used parts by the for-profit sector may be explained by the wider range of electronics handled by the for-profits, and thus more parts are available.

Part Type	Non-profit	For-profit
New Only	0%	0%
Used Only	0%	47%
Both New & Used	100%	53%

E. Workforce, Gross Sales & Projected Reuse Employment

Workforce

The number of employees working in electronics reuse in the for-profit sector is more than 50% greater than in the non-profit sector. In addition, the number of full-time employees is more than double in the for-profit sector as in the non-profit. The role of part-time employees as a percentage of the workforce is also quite different: 35% in the for-profit sector, 46% in the non-profit sector.

Gross Sales

The for-profit sector was well balanced in its whole unit and electronic component sales. By contrast, the non-profit sector was heavily weighted toward whole unit sales.

Projected Employment in Reuse Industry

When asked about the anticipated number of people that will be employed at their facilities for electronics reuse over the next five years, 37% of the non-profits were unsure and 27% said the numbers would either increase or remain the same. In contrast, 59% of the for-profits anticipated employee numbers to increase and 36% said it would either remain the same or that they were unsure. Neither sector anticipated a decrease in employee numbers for reuse activities.

The majority of respondents (54% non-profit, 77% for-profit) expected that at least the current volume of material would continue to be available and to be adequate to sustain current reuse employment. The majority of the for-profit sector and a quarter of the non-profit sector foresaw growth.

III. OPERATION DETAILS

A. Customers

Incoming Material Suppliers

The three primary sources of the non-profit respondents' incoming materials were businesses, industry and government, while the for-profits' primary sources were businesses, institutions and government.

Used Electronics Purchasers

The three primary customers of the non-profit respondents for used electronics purchases were charities/non-profits, individuals, and institutions, while the three

primary customers of the for-profits were businesses, charities/non-profits and institutions.

Customer Overview

Charities/non-profits constitute a significant proportion of the for-profit sector’s end markets. This suggests that the for-profit sector relies on the non-profit reuse infrastructure as one of its primary outlets for selling its product. Industry represents a negligible portion of incoming material to both sectors, and is not a purchaser of reused material in either sector. Government is also not well represented in either sector. From previous experience, NERC concludes that this may be due to barriers presented by procurement laws for purchasing of equipment with reused components and for managing surplus property.

B. Materials

Materials Accepted

The for-profit sector consistently accepts most computer components. See Table ES-5. The non-profit sector, by contrast, is far more restrictive in the materials it handles, and there is a demonstrated preference for whole computer units – i.e., CPUs, CRTs, laptops, and keyboards. Approximately half the survey respondents in each category accepted televisions.

Table ES- 5. Materials Accepted

Respondents	CPU	Key-board	CRT	Lap-top	Hard Drive	CD Drive	Disk Drive	Mother-board	Component Board	TV	Other
Non-Profit	100%	82%	91%	91%	73%	73%	73%	46%	36%	55%	46%
For-Profit	96%	91%	91%	91%	96%	91%	87%	87%	87%	57%	78%

In both sectors there was a category of “other materials” accepted. Forty-six percent (46%) of non-profits accepted a short list of “other materials.” Almost twice as large a segment of the for-profit sector (78%) accepted “other materials.” The list of “other materials” handled is quite extensive, reflecting the broader range of end-uses and operation strategies used by the for-profit sector. See Appendix 2 for complete list of “other materials.”

C. Economic Feasibility Criteria for Electronics Reuse

Unit age and physical condition were the two highest ranked criteria for non-profit respondents in determining the economic feasibility of reuse, while the for-profits’ highest criteria were unit speed and the cost to repair or remanufacture. See Table ES-6. The cost to repair or remanufacture was among the lowest criteria for the non-profit sector, as was memory, brand, and feature level: all of which were significant for the for-profit sector.

	Feature Level	Brand	Memory	Other	Cost to Repair/ Remanufacture	Operating System	Speed	Unit Age	Physical Condition
Non-profit	0%	0%	3%	3%	6%	13%	16%	19%	19%
For-profit	6%	9%	13%	3%	28%	9%	38%	16%	22%

Specifications

The non-profit and for-profit sectors showed significant differences in the use of specifications for incoming materials. On average, 74% of the for-profit companies did not have specifications. By contrast, 32% of the non-profit sector did not have specifications. In addition, the non-profit sector generally had more stringent specifications than did the for-profit sector.

D. End-market Destinations

Fifty-five percent (55%) of the survey respondents solely used domestic markets. The remaining 45% use export [14 for-profit and two (2) non-profit respondents]. See Figure ES-2.

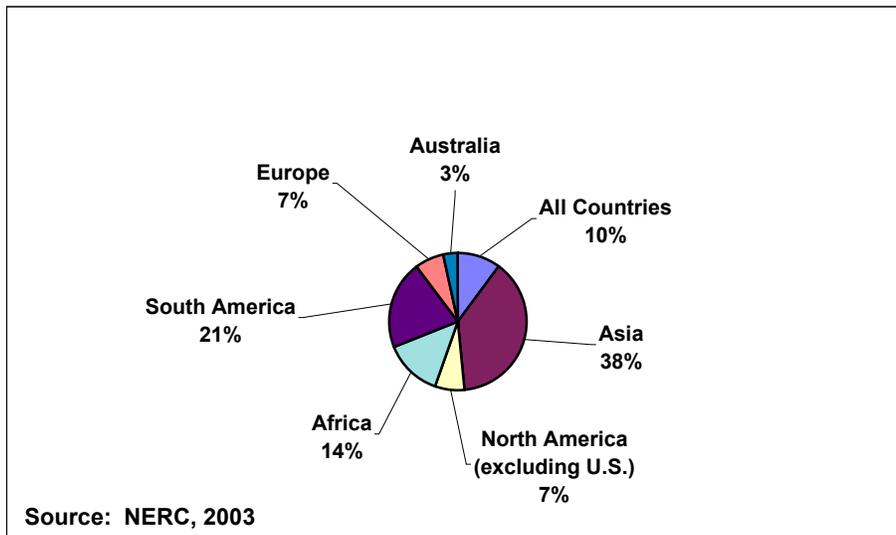


Figure ES-2. Continents Receiving Exported Used Electronics

E. Services Offered

Customer Services

Survey respondents were asked to identify the customer services that they provide from the following list.

- **Discount/Rebate** - Offers discounts or rebates as a purchasing incentive.
- **Take Back Programs** - Will take back any electronic product at its end-of-life that it sells or donates.

- **Technical Support** - Provides technical support for electronics products.
- **Warranties** - Offers some type of warranty on the used electronics.

Overall, the non-profit sector appears to put more resources into supporting reuse end-users than does the for-profit sector. See Table ES-7.

Respondents	Discount/ Rebate	Take Back Program	Technical Support	Warranties
Non-profit	27%	36%	64%	55%
For-profit	32%	50%	23%	36%

Fees Charged for Special Technical Services

Respondents were asked if they charge a fee for the following special technical services:

- **Data removal** – Removal of all data from hard drive
- **Diagnostics Testing** – Testing to determine what parts of the unit work
- **Recycling & Disposal** – Recycling and disposal services offered for non-reusable electronics

Thirty-four percent (34%) of the for-profit respondents charged its customers for data removal, 26% for diagnostics testing, and 15% for recycling and disposal than did the non-profit respondents. See Table ES-8.

Respondents	Diagnostics Testing	Recycling & Disposal	Data Removal
Non-profit	32%	75%	50%
For-profit	58%	90%	84%

Requested Activities

Almost two-thirds of the non-profit sector erased the hard drive and provided new operating software as a standard business practice. Of the remaining one-third, half charged for data removal upon request of the customer. See Table ES-9. The few companies that did not automatically wipe the hard drive usually charged for the service upon request of the customer. In neither sector is new operating software readily available as an option.

Respondents	Provides Operating Software	Wipes Hard Drive
Non-profit	64%	64%
For-profit	17%	87%

The majority of respondents in both sectors charged an additional fee if the source of incoming material requested recycling or disposal as compared to reuse. There were additional fees for diagnostics in many cases as well. The non-profit sector did not typically charge an additional fee for this service because diagnosing a product is integral to determining whether it can go directly to reuse or is in need of repair.

Outgoing Products

Fourteen (14) facilities provided data on the amount of material reused in the past year. The total was 4,651 tons of electronics.^{vi} See Tables ES-10 and ES-11. The non-profits reported 5,015 units of other electronics. None of the survey respondents maintained reuse data for individual CD drives, disk drives, or motherboards.

	CPU	Keyboard	Monitor/ CRT	Laptop	TV	Hard Drive	CD Drive	Disk Drive	Mother- board	Total
Units	20,760	80,770	88,250	1,000	5,000	-	-	-	-	195,780
Pounds	622,800	80,770	2,647,500	8,000	225,000	795	825	950	950	940,090
Tons	311	40	1,324	4	113	0.40	0.41	0.48	0.48	1,794

	CPU	Key- board	Monitor/ CRT	Laptop	TV	Hard Drive	CD Drive	Disk Drive	Mother- board	Other	Total
Units	48,931	70,000	97,514	8,886	10,000	-	-	-	-	-	235,331
Pounds	1,467,930	70,000	2,925,420	71,088	450,000	100	100	0	250,000	479,991	5,714,629
Tons	734	35	1,463	36	225	.05	.05	0	125	240	2,857

While these figures are impressive, they represent a small percentage of the overall potential. According to an EPA report completed by Franklin Associates, the total generation of information consumer electronics in 2000 was approximately 1 million tons nationally. It was further estimated that approximately 9% was recovered for recycling.^{vii} In the Northeast, this would represent approximately 190,000 tons.^{viii}

^{vi} Conversion Weights Used: CPUs – 30lbs/unit, Keyboards – 1lb/unit, CRTs – 30lbs/unit, Laptops – 8lbs/unit, TVs – 45lbs/unit. Sources: Per Scholas; Regional Computer Recycling & Recovery; and EPA, Region I.

^{vii} "Municipal Solid Waste in the United States: 2000", EPA, Office of Solid Waste and Emergency Response, EPA530-R-02-00

^{viii} The population of the Northeast is 19% of the U.S. population. Applying this as a proportion of consumer activity results in 1,000,000 tons nationally * .19 = 190,000 tons of computers generated in the Northeast in 2000.

Therefore, the respondents' activity represents approximately 2% of the estimated recycling activity in the region.

Fees & Sales Price

Overall the non-profits charged lower incoming fees and selling prices than did the for-profit companies. But, both sectors averaged a \$0 selling price approximately half the time. This figure is somewhat deceptive, however, when it stands on its own. It is important to compare the incoming fee and sale price per device.^{ix}

In the non-profit sector there was a pattern of accepting almost any material that met their specifications for free. The for-profit sector accepted materials for free only 1/3 of the time and generally has lower specifications.

While the average percentage that products are "sold" for free is approximately the same in the non-profit and for-profit sectors, the relationship between incoming fees and selling prices is significant. In the non-profit sector, there were no products for which more material went out for free than came in for free (on average 83% of the material came in for free and 55% went out for free) In the for-profit sector, approximately 37% of the material comes in for free and an even greater percentage (52%) goes out for free. This results in the for-profits making the majority of their revenues from incoming fees.

IV. GREENHOUSE GAS EMISSION SAVINGS

As a result of the diversion to reuse of 1,045 tons of whole unit computers by survey respondents, more than 1 trillion British Thermal Units (BTUs) were saved. See Table ES-12. These BTU savings are equivalent to saving 172,474 barrels of oil, or 7.2 million gallons of gasoline, or a reduction of 14,393 cars from the road per year, and a reduction in CO₂ emissions by 71,967 tons per year.^x

Table ES-12. Greenhouse Gas Emission Savings^{xi}

	Whole Unit Computer Tonnages	Million BTU Savings	Barrels of Oil Saved	Gallons of Oil Saved	Gallons of Gas Saved	Reduction of Cars on the Road/ Year	Reduction of Car Emissions CO₂ Tons/ Year
Non-profit	311	297,711	51,329	2,155,838	2,381,688	4,284	21,418
For-profit	734	702,636	121,144	5,088,055	5,621,089	10,110	50,549
Total	1,045	1,000,347	172,474	7,243,893	8,002,777	14,393	71,967

^{ix} Refer to Appendix 2. for a complete list of respondents' materials accepted, fees charged and required specifications.

^x The greenhouse gas emission savings for the tonnage of reused computers reported in this study was calculated using EPA's *Draft Background Document for Life-Cycle Greenhouse Gas Emission Factors for Carpet and Personal Computers, December 2002*. Only whole unit computers (CPU, monitor and keyboard) were included, due to the limitations of this calculation. Thus, the calculations do not reflect reuse parts, individual components, or televisions.

^{xi} Refer to Appendix 3 for EPA's greenhouse gas emission savings calculations for computer reuse.

V. CONCLUSION

A. Observations

Materials Handled & Pricing

1. Non-profits focused on whole unit computers. The sector has very specific requirements for incoming materials in order to ensure that it can be readily sold or donated for reuse.
2. The for-profit companies accepted a wider range of consumer electronics and had less stringent specifications than the non-profit sector.
3. On average, the for-profit companies lacked specifications 74% of the time. The non-profit sector lacked specifications 32% of the time.
4. The pricing structure for incoming and outgoing materials was complicated. Prices for incoming and outgoing used electronics change daily.
5. All of the electronics handled by the non-profits went for reuse.
6. The for-profit sector sales were relatively balanced between whole unit and electronic component sales. The non-profit sector was heavily weighted toward whole unit sales, demonstrating its focus on reuse.
7. Approximately half the survey respondents accepted televisions.
8. The difference in criteria used to determine the reuse potential of the accepted materials by the for-profits and non-profits mirrored the rigor of their specifications.

Customers

1. Charities/non-profits constituted a significant proportion of the for-profit sector's end markets. This suggests that the for-profit sector relied on the non-profit reuse infrastructure as a primary outlet for moving material for reuse.
2. Industry represented a negligible portion of incoming material and was not an end market customer of reused material for either sector.
3. Government participation was not well represented in either sector. From experience, NERC concludes that government may limit its participation in electronics reuse due to the barriers presented by procurement laws to both the purchase of equipment with reused components and for the management of surplus property.
4. A very small amount of material came from individuals. This is an indication of the growth potential from the consumer market.

5. More than half of the respondents' sold/donated used electronics solely to domestic markets. The remaining 45% engaged in some degree of export (61% of the for-profit and 18% of the non-profit respondents).
6. The non-profit sector put more resources into supporting reuse end-users than did the for-profit sector.
7. Almost two-thirds of the non-profit sector erased the hard drive and provided new operating software as a standard business practice.
8. Among the for-profit respondents, a small minority provided new operating software, but almost all of the companies wiped the hard drive as part of its standard practice.
9. The supply side of the reuse equation is expanding rapidly, and is poised for even greater growth over the next five years due to policy and legal changes related to consumer electronics.

Viability

1. The majority of the for-profit sector and a quarter of the non-profit sector foresee growth in the electronics reuse industry.
2. Several survey respondents anticipate expanding demanufacturing operations.
3. The survey respondents' reuse activity represents approximately 2% (based on weight) of the electronics recycling activity in the region.
4. Remanufacturing is becoming an obsolete strategy for for-profit electronics recycling companies. The labor- and material-intensive nature of remanufacturing can no longer compete with the low cost of new computers. At the same time, remanufacturing is a feasible operation for non-profit organizations.
5. Approximately half of the for-profit companies attributed total gross sales to a combination of whole unit electronics and electronic components.
6. The primary revenue source for the for-profits was fees for accepting materials – service fees were greater than sales.
7. The viability of any business is dependent upon overhead expenses and labor costs. Non-profits are more likely to employ prison populations and volunteers, and may also have donated operating space. These subsidies may mask the true viability of the business, much in the same way as do low labor costs in foreign countries.

B. Recommendations

1. Market development

- a. Establishing a strong customer base for reused electronics will ensure the ability of these materials to move through the marketplace as a commodity rather than scrap.
- b. Government can play a significant role by actively promoting the use of reused electronics in government offices. A number of survey respondents believe that government participation is essential in order to strengthen the electronics reuse industry.
- c. Industry consumers present significant areas for end-market development.

2. **Technical support** for used electronics purchasers/users is important to strengthen the industry.

3. **Licensed operating software** is an added feature that can support the viability of the electronics reuse market. Over the past five years, the cost of software has been consistently identified as a factor that impacts the financial viability of reuse.

4. **Export.** With 45% of the survey respondents exporting some or all of their used electronics, the need to know what happens to these materials once they reach their final destination becomes important. As more governments and consumers become aware of this issue, and concerned about the answer, ensuring that these materials are dealt with in an environmentally sound manner will ultimately benefit both the for-profit and non-profit sectors.

5. Further study

- a. Research the impact of labor costs and overhead on the reuse market.
- b. Evaluate the reuse market for individual components.

C. Summary

The reuse sector is decades old but it has traditionally focused on televisions and stereos. The addition of computers and other advanced electronics to the existing infrastructure has resulted in dramatic changes. The supply side of the reuse equation is expanding rapidly, and is poised for even greater growth over the next five years due to policy and legal changes related to consumer electronics. In addition to the significant resource conservation value of reuse, there is potential for dramatic savings in greenhouse gas emissions. With only a fraction of the material diverted to reuse included in an overall calculation of this benefit, a trillion BTUs were saved.

At this time, however, there is an inadequate end market available to support reuse as a value added aspect of a business plan, and it brings into serious question whether this sector can be economically sustained.

In order for reuse to become an economically viable management tool for consumer electronics there must be increased market development. Some of the key market development opportunities identified by this study were:

1. Government, consumers, and industry are potential untapped sources of quality material for reuse.
2. Businesses, institutions and industry should be targeted for increased electronics reuse.
3. Computer reuse will be enhanced by consumer support similar to what is provided at retail, including:
 - a. Operating software provided with the units,
 - b. Technical assistance provided to consumers,
 - c. Warranties on hardware, and
 - d. End of life take back.
4. Reuse companies need to ensure that exported materials are dealt with in an environmentally sound manner.
5. Asset recovery may present an opportunity for non-profit organizations, if data security can be guaranteed.

Increased attention to end-of-life management of electronics at the state, local and federal level, and international reuse markets bring new opportunities for economic expansion. In addition, the significant potential for greenhouse gas emission savings should act as a driver. Focused and strategic attention will be required, however, to sustain reuse as an economically feasible end-of-life management strategy.

I. INTRODUCTION

A. Overview

With the quick rate at which consumer electronics become obsolete and the increasing momentum to divert these materials from landfills, making use of these resource-rich discards has created an opportunity for electronic reuse operations to increase throughout the country. In addition to the resource conservation value of reuse is the associated significant greenhouse gas emission savings. In order to better understand the market demand and economic viability for reused, remanufactured and repaired electronics, the Northeast Recycling Council, Inc. (NERC) conducted an on-line survey of reuse facilities serving the Northeast¹. Although the information obtained through this project is a snapshot of the Northeast's electronics reuse industry from December 2002 through March 2003, it is considered to be baseline information for this industry sector.

This analysis is presented in five sections:

- Introduction
- Overview of Respondents
- Operation Details
- Greenhouse Gas Emission Savings
- Conclusion

B. Background

In order to ensure that all potential consumer electronics reuse companies serving the Northeast were identified, and that the survey would result in the type of data states believed would provide them with the best baseline information, a project Advisory Committee was developed. The Committee members assisted NERC with developing lists of consumer electronics reuse companies either located in or serving the ten Northeast states. The Committee prioritized the facilities, based on knowledge of the company, its operation(s) and geographic distribution, into a primary contact list of 70 facilities. The Committee also played a major role in developing the survey, including writing definitions. The draft survey was distributed to several consumer electronics reuse companies that agreed to serve as the survey "testers." Their comments and suggestions helped to improve the form and substance of the final survey.²

The Committee decided that an on-line survey was the most efficient method for obtaining the information. Since it can be challenging to secure survey responses, NERC and the Committee decided to telephone each electronic reuse facility manager to formally introduce the project and encourage them to complete the survey. At least three and as many as five attempts, as necessary, were made to directly contact each facility manager.

¹ CT, DE, ME, MA, NH, NJ, NY, RI, PA, VT

² The survey can be found in Appendix 1.

The combined strategy of contacting facility managers in advance of distributing the survey request and having an on-line survey resulted in 49% of the facilities completing the survey.

Of those not participating:

- 26% did not return our calls,
- 13% were not engaged in consumer electronics processing,
- 6% refused to fill out the survey,
- 3% had no telephone listing,
- 3% went out of business between the time the list was compiled and when they were called.

After receiving the survey responses, NERC called four for-profit companies and five non-profits for clarification of information, and to gain greater insight into the reuse sector and the challenges that each faces.

II. OVERVIEW OF RESPONDENTS

A. Respondents

Non-profit Organizations typically take used electronics and either repair them and/or distribute them "as is" to schools or other institutions for little or no fee. In some cases whole units may be sold or demanufactured.

For-profit Electronic Recycling Companies typically are similar to other for-profit ventures. Their goal is to be financially successful.

Survey respondents were from eight (8) states, including one from California. See Table 1. One-third of the respondents were non-profit organizations, and two-thirds were for-profit companies.

Primary Facility Location	For-profit Companies	Non-profit Organizations	Total
CA	1	0	1
CT	3	1	4
MA	3	1	4
NH	3	2	5
NJ	2	1	3
NY	10	5	15
RI	1	0	1
VT	0	1	1
Total	23	11	34

B. Facilities

Twenty-four percent (24%) of the survey respondents had more than one facility (22% of the for-profit companies and 27% of the non-profits). See Table 2. More for-profit

companies reported multiple facilities than did the non-profits, but the differences were not dramatic: 22% and 27% respectively. A distinction, however, is that none of the non-profit organizations reported having more than one (1) additional facility, while two (2) of the for-profits had two (2) additional facilities.

	% Multiple Facilities	2 Facilities	3 Facilities
Non-profit	27%	27%	0%
For-profit	22%	13%	9%

While only one (1) of the companies with multiple facilities had its primary facility in California, 30% of the respondents had additional facilities in California. See Table 3. This may reflect the growing focus on electronics collection in California and the market opportunities that it presents. Overall, 70% of the additional facilities were located in the same state as the primary facility. All of the survey respondents reported that their operations are the same at all the facilities.

Primary Location	# Additional Facilities	Additional Location(s)	Type
CA	2	TN & CA	For-profit
MA	1	MA	For-profit
MA	1	MA	For-profit
MA	1	MA	Non-profit
NH	1	NH	Non-profit
NJ	1	CA	Non-profit
NY	2	NY	For-profit
RI	1	CA	For-profit
TOTAL	10		

Non-profit Facility Profile

The non-profit respondents have been in existence almost twice as long as the for-profit companies. The non-profit respondents reported an average of 24 years in operation, with seven (7) full-time and six (6) part-time employees. See Appendix 2 for the complete profile. Among these non-profits, whole unit electronics accounted for an average of 51% of gross sales and electronic components for an average of 3% of gross sales. (See Figure 1 for electronics definitions used in this study.) The respondents with 0% sales facilitated the free exchange of materials between donors and recipients. All of the electronics handled by the non-profits were evaluated for reuse.

- ❑ **Whole unit electronics:** intact CPUs, computer keyboards, monitors, & televisions.
- ❑ **Electronic components:** individual components of CPUs, computer keyboards and monitors.

Figure 1. Types of Electronics ~ Definitions

For-profit Facility Profile

The for-profit respondents averaged 14 years in operation, with 19 full-time employees, and six (6) part-time employees. See Appendix 2 for a complete profile. They reported an average of 40% of gross sales from whole unit electronics and 29% of gross sales from electronic components.

C. Operations

The survey asked each respondent to identify its operations by selecting all of the categories listed below that apply to its overall operations. See Figure 2.

- ❑ **Asset Recovery**– Bids on surplus property from government and large companies. May remanufacture, demanufacture and/or sell units “as is”.
- ❑ **Repair Shop/Retailer** - Repairs used electronics for direct resale to consumers - generally small, family-run operations.
- ❑ **Remanufacturing** - Builds whole unit electronics from individual components, or rebuilds electronics for resale to consumers, retailers or brokers.
- ❑ **Demanufacturing** - Demanufactures used electronics for resale of individual components, and may sell workable whole units "as is" to brokers or retailers, or do nominal repair/remanufacture of whole units and then sell them to brokers or retailers.
- ❑ **Brokering** – Buys and sells whole unit electronics or individual components, or, in the case of non-profits, either sells materials or facilitates the free exchange of materials between donors and recipients.

Figure 2. Types of Operations

Operations Comparison

There were a number of significant differences between the non-profit and for-profit sectors. The for-profit sector was much more diversified in its approach to managing electronics, with 43% of the companies relying on a mix of operations, while only 36% of the non-profits were similarly situated. Asset recovery was an operational strategy used only by the for-profit sector.

Brokering is significantly more common in the non-profit sector than in the for-profit: 21% more frequent. See Table 6. Demanufacturing is essentially equal in frequency as an operation, but repair/retail and remanufacture are dramatically different. As mentioned above, asset recovery is entirely absent from the non-profit sector. Remanufacture and repair/retail go hand-in-hand in the non-profit sector. Remanufacturing is more labor intensive than demanufacturing or brokering, and as such, is not as well suited to the for-profit community as to the non-profit. The reason for asset recovery's absence from the non-profit sector is less obvious. It may be due to the large scale of operations that most asset recovery requires, as well as corporate concern about security issues and the reuse of branded electronics.

Operation	For-profit	Non-profit
Asset Recovery	57%	0%
Brokering	43%	64%
Demanufacturing	52%	46%
Remanufacturing	9%	27%
Repair/Retail	13%	27%

Non-profit Operations

Of the 11 non-profit respondents, 36% had more than one type of operation and 64% had only one. See Table 7. Of those with only one type of operation, 29% were demanufacturers and 71% were brokers.

Respondent	Repair/Retail	Remanufacturing	Demanufacturing	Brokering	Asset Recovery
1			X		
2			X		
3				X	
4				X	
5	X	X		X	
6	X	X	X		
7	X	X	X		
8				X	
9				X	
10			X	X	
11				X	

Overall, 64% of the non-profits engaged in brokering, 46% in demanufacturing, 27% repair/retail and 27% in remanufacturing. See Figure 3. All of the non-profits that offered repair/retail services also remanufactured. Two-thirds of these also demanufactured. The one non-profit that did not use demanufacturing, instead used brokering for managing the reuse of unwanted parts and equipment.

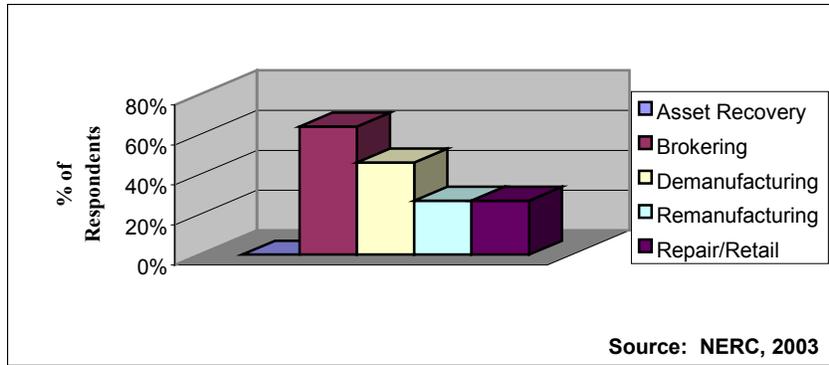


Figure 3. Non-profit Operations

For-profit Operations

Of the 23 for-profit companies, 57% had one type of operation: 38% conducted asset recovery, 32% brokered, 23% demanufactured, and 7% conducted repair/retail. None of the companies depended solely upon remanufacturing. See Table 8. Overall, 57% of the for-profit companies offered asset recovery, 52% offered demanufacturing, 43% offered brokering, 13% repair/retail, and 9% remanufacturing. See Figure 4.

Respondent	Demanufacturing	Repair/Retail	Remanufacturing	Asset Recovery	Brokering
1	X			X	X
2	X			X	
3	X			X	X
4	X	X	X	X	X
5	X				
6	X	X	X		
7	X			X	
8	X			X	
9	X				X
10	X				
11	X			X	X
12	X				
13				X	
14				X	
15				X	
16				X	
17				X	
18				X	X
19		X			
20					X
21					X
22					X
23					X

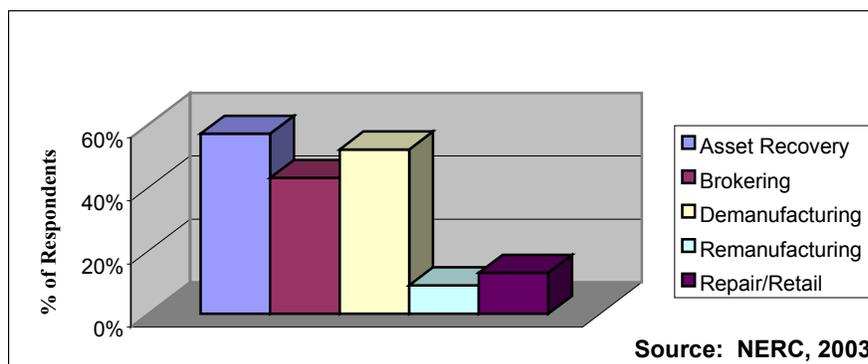


Figure 4. For-profit Operations

D. Parts Used for Remanufacturing

One hundred percent (100%) of the non-profit respondents reported that remanufacturing electronics relied on both new and used parts, while 53% of the for-profit respondents employed both new and used parts, and 47% used parts only. See Table 9. The utilization of more used parts by the for-profit sector than the non-profit sector may be explained by the wider range of electronics handled by the for-profits, and thus more available parts.

Part Type	Non-profit	For-profit
New Only	0%	0%
Used Only	0%	47%
Both New & Used	100%	53%

E. Workforce, Gross Sales & Projected Reuse Employment

Workforce

The number of employees working in electronics reuse in the for-profit sector is more than 50% greater than in the non-profit sector. See Table 10. In addition, the number of full-time employees is more than double in the for-profit sector as in the non-profit. The role of part-time employees as a percentage of the workforce is also quite different: 35% in the for-profit sector, 46% in the non-profit sector.

The difference in number of employees is a reflection of the difference in types of operations in the for- and non-profit sectors, and that more of the for-profits have electronics end-of-life operations apart from reuse.

Respondents	Average		
	Years in Operation	# Full-time Employees	# Part-time Employees
Non-profit	24	7	6
For-profit	14	19	10

Gross Sales

The for-profit sector was well balanced in its whole unit and electronic component sales. By contrast, the non-profit sector was heavily weighted toward whole unit sales, demonstrating its more universal commitment to reuse. See Table 11.

Respondents	Average	
	% Gross Sales Whole Unit Electronics	% Gross Sales Electronic Components
Non-profit	51%	3%
For-profit	40%	29%

Projected Employment in Reuse Industry

When asked about the anticipated number of people that will be employed in electronics reuse over the next five years, 37% of the non-profits were not sure and 27% said the numbers would either increase or remain the same. In contrast, 59% of the for-profits anticipated employee numbers to increase and 36% said it would either remain the same or that were not sure. Neither sector anticipated a decrease in employee numbers for reuse activities. See Table 12.

The volatile nature of this sector may account for the high percentage of respondents that did not have an opinion about the future. The majority of respondents (54% non-profit, 77% for-profit) expected that at least the current volume of material would continue to be available and to be adequate to sustain current reuse employment. The majority of the for-profit sector and a quarter of the non-profit sector foresaw growth. This may be explained by the expectation that more consumer electronics will enter the collection stream as more national, state and local initiatives focus on end-of-life management of electronics. In addition, several of the survey respondents suggested that they anticipated expanding demanufacturing operations, which are labor intensive.

Responses	Non-profit	For-profit
Remain the Same	27%	18%
Increase	27%	59%
Decrease	9%	5%
Don't Know	37%	18%

III. OPERATION DETAILS

A. Customers

Incoming Material Suppliers

The three primary sources of the non-profit respondents' incoming materials were businesses, industry and government, while the for-profits' primary sources were businesses, institutions and government. See Tables 13 and 14. Although the dominance of business, industry and institutional sources is not surprising, the very

small percentage coming from individuals reflects the growth potential from the consumer market. The non-profit and for-profit sectors are not yet receiving, or perhaps able to handle, the tremendous volume of material from households. With the high specifications in the non-profit sector, it is interesting to see that individual donations are not appearing as a class, but rather that non-profit organizations are receiving materials from similar sources as the for-profit companies.

Used Electronics Purchasers

The three primary customers of the non-profit respondents were charities/non-profits, individuals, and institutions, while the three primary customers of the for-profits were businesses, charities/non-profits and institutions.

Sources	Incoming Material Suppliers	Used Electronics Purchasers
Businesses	69%	20%
Industry	13%	0%
Institutions	6%	22%
Government	10%	3%
Charities/Non-profits	2%	32%
Individuals	0%	23%
Other	0%	0%
Total	100%	100%

Sources	Incoming Material Suppliers	Used Electronic Purchasers
Businesses	51%	52%
Industry	7%	0%
Institutions	18%	11%
Government	15%	3%
Charities/Non-profits	1%	22%
Individuals	0%	9%
Other	8%	3%
Total	100%	100%

Customer Overview

Charities/non-profits constitute a significant proportion of the for-profit sector's end markets. This suggests that the for-profit sector relies on the non-profit reuse infrastructure as one of its primary outlets for selling its product. Industry represents a negligible portion of incoming material to both sectors, and is not a purchaser of reused material in either sector. Government is also not well represented in either sector. From previous experience, NERC concludes that this may be due to barriers presented by procurement laws for purchasing of equipment with reused components and for managing surplus property.

B. Materials

Materials Accepted³

The for-profit sector consistently accepts most computer components. The non-profit sector, by contrast, is far more restrictive in the materials it will accept. There is a demonstrated preference for whole computer units – CPUs, CRTs, laptops, and keyboards. Neither sector fully embraces televisions, with approximately half the survey respondents in each category being willing to handle televisions. See Table 15.

Table 15. Materials Accepted

Respondents	CPU	Key-board	CRT	Lap-top	Hard Drive	CD Drive	Disk Drive	Mother-board	Component Board	TV	Other
Non-Profit	100%	82%	91%	91%	73%	73%	73%	46%	36%	55%	46%
For-Profit	96%	91%	91%	91%	96%	91%	87%	87%	87%	57%	78%

The devices most commonly accepted by the non-profit sector were CPUs, CRTs, keyboards, laptops, hard drives and CD drives. While 55% of these organizations accepted TVs, fewer accepted motherboards, component boards, and other electronics.

As for the for-profit sector, CPUs, hard drives, monitors, keyboards, laptops, CD drives, disk drives, motherboards, component boards and other electronic devices were commonly accepted. Televisions were accepted by 57% of the respondents.

In both sectors there was a category of “other materials” accepted. Forty-six percent (46%) of non-profits accepted material from this relatively short list:

- Copiers
- Faxes
- Functional speakers
- Networking equipment
- Printers
- Working laser and ink jet printers.

Almost twice as large a segment of the for-profit sector (78%) accepted “other materials.” The list of other materials handled is quite extensive, reflecting the broader range of end-uses and operation strategies used by the for-profit sector.

- Any computer related products
- Cables
- Copiers
- Fax machines
- Laser and color inkjet printers
- Manufacturers scrap
- Medical equipment

³ Appendix 2 has a complete listing of materials accepted, including required specifications and fees.

- Midrange equipment
- Networking equipment – servers, mainframes and storage devices
- Printers - working and complete
- Telecommunications Equipment
- UPS surge protectors
- Anything electronic in nature

C. Economic Feasibility Criteria for Electronics Reuse

Reuse facilities have criteria for deciding if it is economically feasible to repair or remanufacture equipment for reuse. Unit age and physical condition were the two highest ranked criteria for the non-profit respondents, while the for-profits' highest criteria were unit speed and the cost to repair or remanufacture. See Table 16. The cost to repair or remanufacture was among the lowest criteria for the non-profit sector, as was memory, brand, and feature level, all of which were significant for the for-profit sector.

	Feature Level	Brand	Memory	Other	Cost to Repair/ Remanufacture	Operating System	Speed	Unit Age	Physical Condition
Non-profit	0%	0%	3%	3%	6%	13%	16%	19%	19%
For-profit	6%	9%	13%	3%	28%	9%	38%	16%	22%

Specifications

Reuse facilities often established specific criteria for which materials to accept. The non-profit and for-profit sectors showed significant differences in the use of specifications for incoming materials. On average, 74% of the for-profit companies did not have specifications for electronics. By contrast, 32% of the non-profit sector did not have specifications. However, the lack of specifications for incoming component boards skewed this result. If component boards are omitted, the percentage of non-profits having no required specifications becomes 24%. See Table 17.

Materials	Non-profit		For-profit	
	Highlighted Specifications (% of Total Responses)	No Spec's	Highlighted Specifications (% of Total Responses)	No Spec's
CPUs	88% processing speed	13%	18% processing speed	64%
Keyboards	40% working	20%	11% working	78%
CRTs	63% working, 25% \geq 15"	13%	13% unbroken, 13% \geq 14"	62%
Laptops	83% processing speed	17%	11% working & processing speed	78%
Hard Drives	60% > 1 gigabyte	20%	11% working	78%
CD Drives	67% working	33%	13% working	75%
Floppy Disk Drives	50% working	50%	13% working	75%
Motherboards	33% working, 33% speed	33%	13% working	75%
Component Boards		100%	13% working	75%
Televisions	40% working, 20% brand specific, 20% \leq 15 years	20%	20% unbroken	80%
Average		32%		74%

D. End-market Destinations

Fifty-five percent (55%) of the survey respondents sell or donate used electronics solely to domestic markets. The remaining 45% engage in some degree of export [14 for-profit and two (2) non-profit respondents]. See Figure 5. With such a significant percentage of the companies exporting some or all of its used electronics, the need to know what happens to these materials once they reach their final destination becomes very important. See Figures 6, 7, 8 and 9. As more governments and consumers become aware of this issue, and concerned about the answer, ensuring that these materials are dealt with in an environmentally sound manner will ultimately benefit both the for-profit and non-profit sectors.

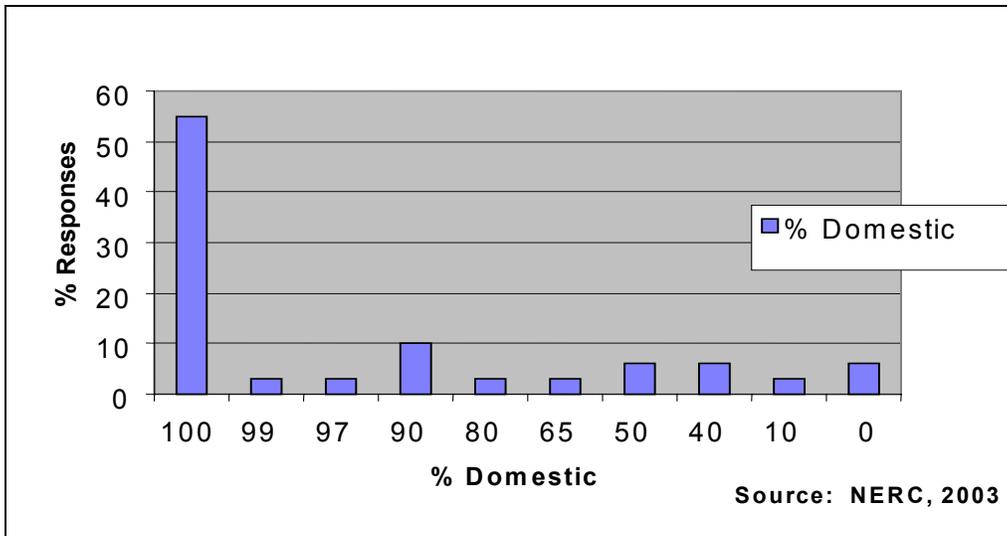


Figure 5. Domestic Markets for Used Electronics

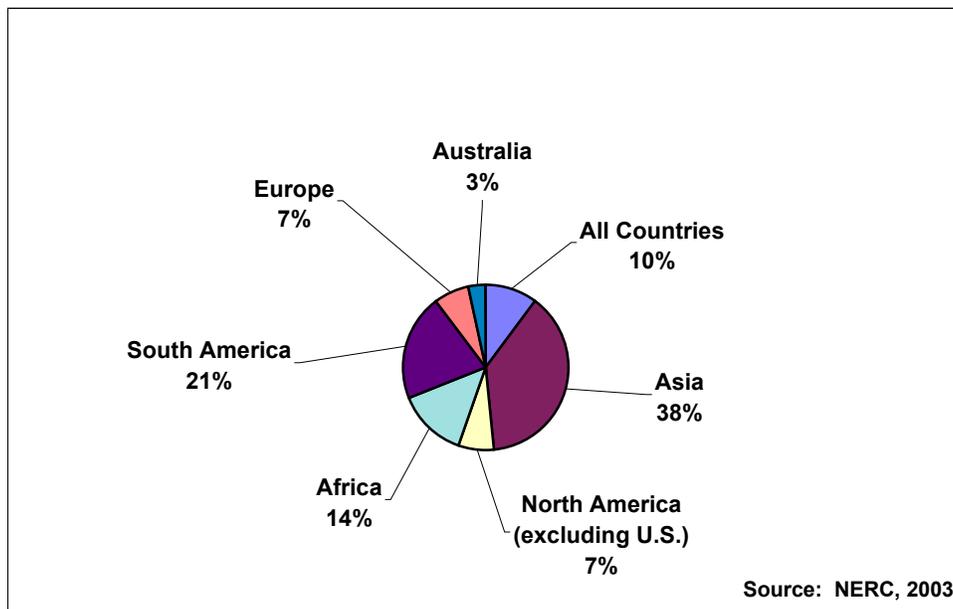


Figure 6. Continents Receiving Used Electronics Exports

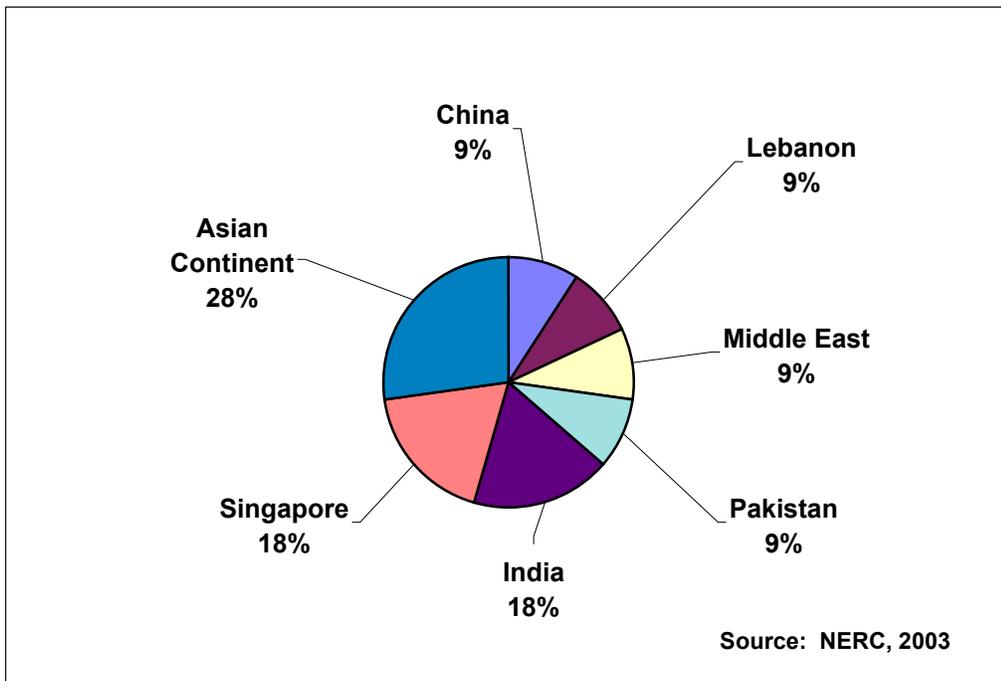


Figure 7. Middle East & Asian Countries Receiving Used Electronics Exports

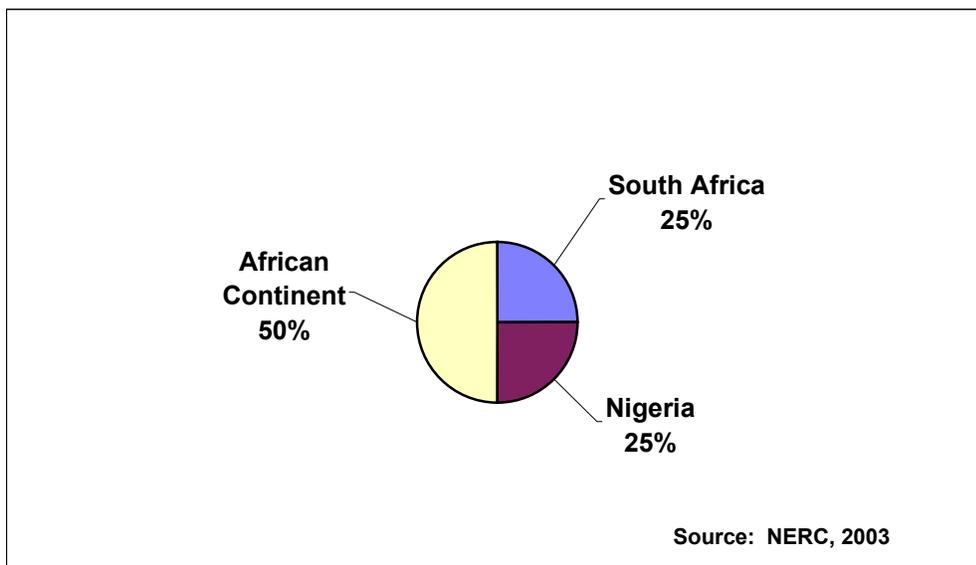


Figure 8. African Countries Receiving Used Electronics Exports

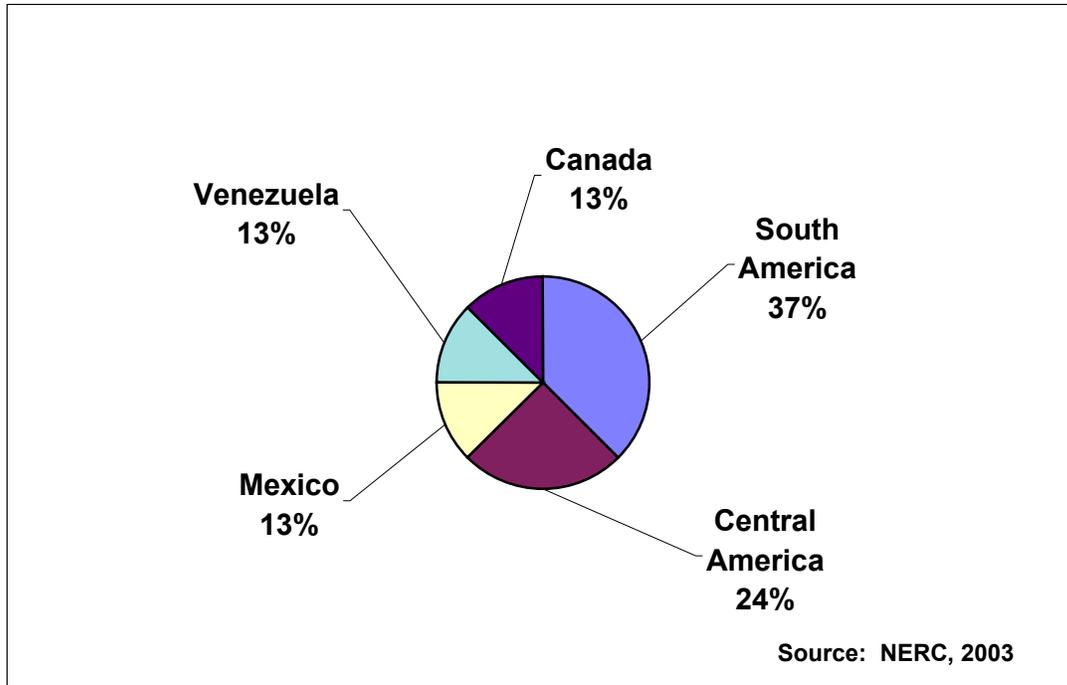


Figure 9. North & South American Countries Receiving Used Electronics Exports (Excluding the U.S.)

E. Services Offered

Customer Services Offered

Overall, the non-profit sector appears to put more resources into supporting its customers than does the for-profit sector. (See Figure 10 for customer service definitions.) Sixty-four percent (64%) of the non-profits provided technical support, 55% provided warranties, and 36% provided take back programs. In contrast, 50% of the for-profits provided take back programs, 36% provided warranties, and 23% provided technical support. The percentages of respondents providing discount/rebate programs were very similar, with only a 5% difference between the two sectors. See Table 18.

These results reflect the different priorities of the for- and non-profit sectors. With the operations of the non-profit sector dedicated 100% to reuse, they are concerned with providing their constituency with the tools they need to be able to fully utilize the used products. On the other hand, the for-profit sector develops its strategies in response to market opportunities and may

Figure 10. Customer Service ~ Definitions

Discount/Rebate - The facility offers discounts or rebates as an incentive for purchasing its electronic products.

Take Back Programs - The facility will take back any electronic product at its end-of-life that it then sells or donates.

Technical Support - The facility provides technical support for electronics products that it sells or donates.

Warranties - The facility offers some type of warranty on the used electronics it sells.

engage in non-reuse operations. This may make the for-profits better equipped to offer take back programs, because they can handle non-reusable materials.

Table 18. Customer Services Offered

Respondents	Discount/ Rebate	Take Back Program	Technical Support	Warranties
Non-profit	27%	36%	64%	55%
For-profit	32%	50%	23%	36%

Fees Charged for Special Technical Services

Overall, more of the for-profits charged for special technical services than the non-profits. See Figure 11 for technical services definitions and Table 19 for respondent data.

Figure 11. Special Technical Services ~ Definitions

Data removal – Permanent removal of all data from hard drive.

Diagnostics Testing – Analysis to determine which parts of the unit work.

Recycling & Disposal – Recycling and disposal services offered for non-reusable electronics.

Table 19. Fees Charged for Special Technical Services

Respondents	Diagnostics Testing	Recycling & Disposal	Data Removal
Non-profit	32%	75%	50%
For-profit	58%	90%	84%

Requested Activities

Almost two-thirds of the non-profit sector erased the hard drive and provided new operating software as a standard business practice. Of the remaining one-third, half charged for data removal upon request of the customer. See Table 20. The few companies that did not automatically erase the hard drive usually charged for the service upon request of the customer.

Of the companies providing new software, one reported providing two different operating systems - DOS and New Deal. Another company provides the original operating software after erasing the hard drive. In neither sector is new operating software readily available as an option.

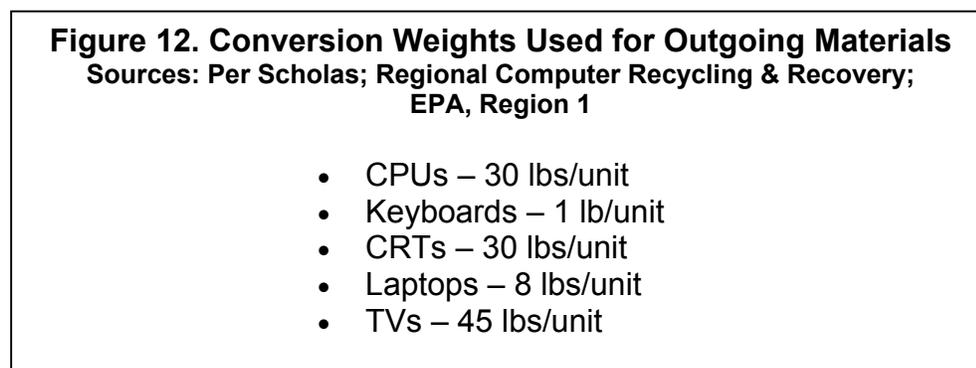
Table 20. Standard Practice		
Respondents	Provides Operating Software	Erases Hard Drive
Non-profit	64%	64%
For-profit	17%	87%

In national and regional discussions, providing operating software has consistently been highlighted as essential to a viable reuse market for computers. It is almost as consistently pointed out as one of the significant costs that impact the financial viability of such efforts.

The majority of respondents in both sectors charged an additional fee if the source of incoming material requests recycling or disposal as compared to reuse. There were additional fees for diagnostics in many cases as well. The non-profit sector did not typically charge an additional fee for this service because diagnosing a product is integral to determining whether it can go directly to reuse or is in need of repair.

Outgoing Products

Fourteen (14) facilities contributed to the reuse of 4,651 tons of electronics in one year. Figure 12 for conversion weights and Tables 21 and 22 for data.



In addition to the outgoing material presented in Table 20, the non-profits reported 5,015 units of other electronics. None of the survey respondents maintained reuse data for individual CD drives, disk drives, or motherboards.

Table 21. Non-profit Outgoing Products Sold or Donated										
	CPU	Keyboard	Monitor/ CRT	Laptop	TV	Hard Drive	CD Drive	Disk Drive	Mother- board	Total
Units	20,760	80,770	88,250	1,000	5,000	-	-	-	-	195,780
Pounds	622,800	80,770	2,647,500	8,000	225,000	795	825	950	950	940,090
Tons	311	40	1,324	4	113	0.40	0.41	0.48	0.48	1,794

Table 22. For-profit Outgoing Products Sold or Donated

	CPU	Key-board	Monitor/CRT	Laptop	TV	Hard Drive	CD Drive	Disk Drive	Mother-board	Other	Total
Units	48,931	70,000	97,514	8,886	10,000	-	-	-	-	-	235,331
Pounds	1,467,930	70,000	2,925,420	71,088	450,000	100	100	0	250,000	479,991	5,714,629
Tons	734	35	1,463	36	225	.05	.05	0	125	240	2,857

While these figures are impressive, they represent a small percentage of the overall potential. According to an EPA report completed by Franklin Associates, the total generation of information consumer electronics in 2000 was approximately 1 million tons nationally. It was further estimated that approximately 9% was recovered for recycling.⁴ In the Northeast, this would represent approximately 190,000 tons.⁵ Therefore, the respondents' activity represents approximately 2% of the estimated recycling activity in the region.

Fees & Sales Price

There is a tremendous variation in fees within both the for-profit and non-profit sectors – especially the selling prices. (Refer to Appendix 3 for a complete list of fees and selling prices.) Overall the non-profits charged lower fees and selling prices than did the for-profit companies. For example, on average, the non-profit sector charged no incoming fees 83% of the time, by contrast to the for-profit sector in which this occurred 37% of the time. See Table 23.

Table 23. Likelihood of No Incoming Fees or Selling Prices

Material Type	Non-profit		For-profit	
	Incoming Fees	Selling Price	Incoming Fees	Selling Price
	\$0	\$0	\$0	\$0
Keyboards	80%	60%	50%	38%
CPUs	60%	40%	38%	63%
CRTs	60%	60%	11%	40%
Laptops	75%	75%	29%	29%
Hard Drives	100%	33%	43%	57%
CD Drives	100%	33%	43%	57%
Floppy Disk Drives	100%	50%	67%	50%
Motherboards	100%	50%	43%	71%
Component Boards	100%	100%	33%	50%
Televisions	50%	50%	13%	63%
Average	83%	55%	37%	52%

⁴ "Municipal Solid Waste in the United States: 2000", EPA, Office of Solid Waste and Emergency Response, EPA530-R-02-00

⁵ The population of the Northeast is 19% of the U.S. population. Applying this as a proportion of consumer activity results in 1,000,000 tons nationally * .19 = 190,000 tons of computers generated in the Northeast in 2000.

Selling prices show a different trend, with both sectors averaging a "\$0" price approximately 50% of the time. This figure is somewhat deceptive, however. It is important to compare the incoming fee and sale price per device to understand what is truly happening.⁶

In the non-profit sector there is a pattern of accepting almost all materials that met specifications for no fee. However, the materials must generally meet a higher standard than is required by for-profit companies. Thus, although there is no incoming material fee charged, the non-profit can be assured of a certain quality that will meet its needs, without having to pay disposal or recycling fees. Instead, the non-profit can have confidence that the material will be able to be reused: either as a part or as a device itself. Thus, the higher standards replace a need for more revenue at the incoming side of the equation. The for-profit sector, which accepts materials for free only 1/3 of the time, has much lower standards for material quality and thus needs to charge fees.

While the average percentage that products are "sold" for free is approximately the same in the non-profit and for-profit sectors, the relationship between incoming fees and selling prices is significant. In the non-profit sector, there were no products for which more material went out for free than came in for free (on average 83% of the material came in for free and 55% went out for free. This reflects the ability of the non-profits to primarily engage in a free exchange. In the for-profit sector, the image is essentially reversed. Approximately 37% of the material comes in for free and an even greater percentage (52%) goes out for free. This results in the for-profits making the majority of their revenues from incoming fees.

The non-profits are able to sustain a 100% reuse practice and serve their mission by pairing the desire to get rid of something, with a need for it elsewhere; thus the need for the higher specifications. This is not practical in the for-profit world, because the resale of used electronics is worth less than the incoming material.

This observation is borne out by several of the for-profit survey respondents, when asked about the economic potential of reuse markets. Respondents' comments included:

- "The opportunities are limited at best. It is becoming rapidly more difficult to build any kind of economic model to market repaired/remanufactured computer equipment in lieu of declining new equipment pricing and rapid advances in technology."
- "Even with the prices of computer systems coming down, offering an Internet ready, repaired/remanufactured system with an operating system and software package has a domestic market that will continue to grow in the near future."
- "As hardware/software advances and is replaced with newer technology, poorer schools and community-based organizations will be hungry for the "newer" "old" technology."

⁶ Refer to Appendix 2 for a complete list of respondents' accepted materials, fees charged and required specifications.

- “Technology becomes obsolete too quickly. Export is environmentally dangerous or despicable, and replacement equipment is too cheap. The reuse market will soon reach beyond saturation that is why end of life management will become the major part of the industry.”
- “Our business has been declining for three years as prices for new systems fall and the economy declines.”
- “Standard economic policies apply . . . the further we go along, the newer the stuff we repaired/remanufactured is going to have to be.”
- “For generic components and higher-end telecom, electronic test equipment; for PC's and office equipment, growth is probably in export markets.”

IV. GREENHOUSE GAS EMISSION SAVINGS

The greenhouse gas emission savings for the tonnage of reused computers reported in this study was calculated using EPA's *Draft Background Document for Life-Cycle Greenhouse Gas Emission Factors for Carpet and Personal Computers, December 2002*. Only whole unit computers (CPU, monitor and keyboard) were included, due to the limitations of this calculation. Thus, televisions, components and parts reused are not reflected in the data. In addition, the type of data required to calculate the greenhouse gas emission savings was provided by fifteen percent (15%) of the total survey respondents. As a result, the greenhouse gas savings reported here represent an extremely conservative estimate of the total impact of the reuse activities of the respondents.

The reuse of 1,045 tons of whole unit computers represents

- More than 1 trillion British Thermal Units (BTUs) saved in one year. See Table 24.

This is equivalent to an annual savings of:

- 172,474 barrels of oil
- 7.2 million gallons of gasoline
- 14,393 fewer cars on the road,
- 71,967 tons in CO₂ emissions.

Table 24. Greenhouse Gas Emission Savings⁷

	Whole Unit Computer Tonnages	Million BTU Savings	Barrels of Oil Saved	Gallons of Oil Saved	Gallons of Gas Saved	Reduction of Cars on the Road/ Year	Reduction of Car Emissions CO ₂ Tons/ Year
Non-profit	311	297,711	51,329	2,155,838	2,381,688	4,284	21,418
For-profit	734	702,636	121,144	5,088,055	5,621,089	10,110	50,549
Total	1,045	1,000,347	172,474	7,243,893	8,002,777	14,393	71,967

V. CONCLUSION

A. OBSERVATIONS

Materials Handled & Pricing

1. Non-profits focused on whole unit computers. The sector has very specific requirements for incoming materials in order to ensure that it can be readily sold or donated for reuse.
2. The for-profit companies accepted a wider range of consumer electronics and had less stringent specifications than the non-profit sector. This suggests that the for-profit sector is interested in getting the greatest volume of material and then determines which electronics can be reused or which would be more profitably send for recycling or disposal.
3. On average, the for-profit companies lacked specifications 74% of the time. The non-profit sector lacked specifications 32% of the time.
4. The pricing structure for incoming and outgoing materials was complicated. Prices for incoming and outgoing used electronics change daily.
5. All of the electronics handled by the non-profits went for reuse.
6. The for-profit sector sales were relatively balanced between whole unit and electronic component sales, suggesting the flexibility to take advantage of market opportunities as they arise. The non-profit sector was heavily weighted toward whole unit sales, demonstrating its focus on reuse.
7. Approximately half the survey respondents accepted televisions.
8. This difference in criteria to determine reuse potential mirrored the rigor of the specifications.

⁷ Refer to Appendix III for EPA's greenhouse gas emission savings calculations for computer reuse.

Customers

1. Charities/non-profits constituted a significant proportion of the for-profit sector's end markets. This suggests that the for-profit sector relied on the non-profit reuse infrastructure as a primary outlet for moving material for reuse.
2. Industry represented a negligible portion of incoming material and was not an end market customer of reused material for either sector.
3. Government participation was not well represented in either sector. From experience, NERC concludes that government may limit its participation in electronics reuse due to the barriers presented by procurement laws to both the purchase of equipment with reused components and for the management of surplus property.
4. A very small amount of material came from individuals. This is an indication of the growth potential from the consumer market.
5. More than half of the respondents' sold/donated used electronics solely to domestic markets. The remaining 45% engaged in some degree of export (61% of the for-profit and 18% of the non-profit respondents).
6. The non-profit sector put more resources into supporting reuse end-users than did the for-profit sector.
7. Almost two-thirds of the non-profit sector erased the hard drive and provided new operating software as a standard business practice.
8. Among the for-profit respondents, a small minority provided new operating software, but almost all of the companies wiped the hard drive as part of its standard practice.
9. The supply side of the reuse equation is expanding rapidly, and is poised for even greater growth over the next five years due to policy and legal changes related to consumer electronics.

Viability

1. The majority of the for-profit sector and a quarter of the non-profit sector foresee growth in the electronics reuse industry. However, when interviewed, several for-profit companies were pessimistic about the industries future.
2. Several survey respondents anticipate expanding demanufacturing operations, which are labor intensive.
3. The survey respondents' reuse activity represents approximately 2% (based on weight) of the electronics recycling activity in the region.

4. Remanufacturing is becoming an obsolete strategy for for-profit electronics recycling companies. The labor- and material-intensive nature of remanufacturing can no longer compete with the low cost of new computers. At the same time, remanufacturing is a feasible operation for non-profit organizations.
5. Approximately half of the for-profit companies attributed total gross sales to a combination of whole unit electronics and electronic components.
6. The primary revenue source for the for-profits was fees for accepting materials. This speaks strongly to the lack of suitable end markets for reused electronics as a valuable commodity.
7. The viability of any business is dependent upon overhead expenses and labor costs. Non-profits are more likely to employ prison populations and volunteers, and may also have donated operating space. These subsidies may mask the true viability of the business, much in the same way as do low labor costs in foreign countries.

B. RECOMMENDATIONS

1. Market development

- a. Establishing a strong customer base for reused electronics will ensure the ability of these materials to move through the marketplace as commodity rather than scrap.
- b. Government can play a significant role by actively promoting the use of reused electronics in government offices. A number of survey respondents believe that this is essential in order to strengthen the electronics reuse industry.
- c. Industry presents another significant area for end-market development.

2. Technical support for used electronics purchasers/users is important to strengthen the industry.

3. Licensed operating software is an added feature that can support the viability of the electronics reuse market. Over the past five years, the cost of software has been consistently identified as a factor that impacts the financial viability of reuse.

4. Export. With 45% of the survey respondents exporting some or all of their used electronics, the need to know what happens to these materials once they reach their final destination becomes important. As more governments and consumers become aware of this issue, and concerned about the answer, ensuring that these materials are dealt with in an environmentally sound manner will ultimately benefit both the for-profit and non-profit sectors.

5. Further study

- a. Research the impact of labor costs and overhead on the reuse market.

- b. Evaluate the reuse market for individual components.

6. Greenhouse Gas Emissions. Develop tools for reuse enterprises to accurately report reuse diversion in order to fully quantify the environment impact of this activity.

C. SUMMARY

This study reports on a snapshot of the electronics reuse industry. Although the sector is decades old it has traditionally focused on televisions and stereos. The addition of computers and other advanced electronics to the existing infrastructure has caused dramatic changes. The supply side of the reuse equation is expanding rapidly, and is poised for even greater growth over the next five years due to policy and legal changes related to consumer electronics. In addition to the significant resource conservation value of reuse, there is the potential for dramatic savings in greenhouse gas emissions.

At this time, however, there is an inadequate end market available to support reuse as a value added aspect of a business plan, and it brings into serious question whether this sector can be economically sustained. Despite the current economic challenges, there are real opportunities for strengthening the sector.

In order for reuse to become an economically viable management tool for consumer electronics there must be increased market development. Some of the key market development opportunities identified by this study were:

1. Government, consumers, and industry are potential untapped sources of quality material for reuse.
2. Businesses, institutions and industry should be targeted for increased electronics reuse.
3. Computer reuse will be enhanced by consumer support similar to what is provided at retail, including:
 - a. Operating software provided with the units,
 - b. Technical assistance provided to consumers,
 - c. Warranties on hardware, and
 - d. End of life take back.
4. Reuse companies need to ensure that exported materials are dealt with in an environmentally sound manner.
5. Asset recovery may present an opportunity for non-profit organizations, if data security can be guaranteed.

With the rapidly decreasing cost of new computers and televisions, reuse end markets face increasing competition from new products. At the same time, increased attention to end-of-life management of electronics at the state, local and federal level, and international reuse markets bring new opportunities for economic expansion. In addition, the significant potential for greenhouse gas emission savings should act as a driver. Focused and strategic attention will be required, however, to sustain reuse as an economically feasible end of life management strategy.

VI. APPENDICES

Appendix 1. Survey Questionnaire

Market Study on Directing Used Electronics to Reuse Survey Questionnaire Northeast Recycling Council, Inc. March 2002

For the purpose of this study,

- Whole unit electronics are intact CPUs, computer keyboards and monitors, laptops, and televisions; electronic components are hard drives, CD drives, disk drives, mother boards, and other component boards;
- Used electronics are those sold "as is"; and
- Refurbished electronics are those fixed or upgraded prior to resale.

A. COMPANY BACKGROUND

1. Company Information

Contact Person's Name _____
Title _____
Company Name _____
Mailing Address _____
City _____
State _____
Zip Code _____
Phone _____
Fax _____
Email Address _____
Website Address _____

2. Physical address for each electronic reuse or refurbishing facility owned or operated by above company, if different from mailing address.

Contact Person's Name _____
Title _____
Facility Name _____
Street Address _____
City _____
State _____
Zip Code _____
Phone _____
Fax _____

3. How many years has your primary company been operating? _____

4. How many total employees do you have at your reuse or refurbishing facility(ies)?

Full Time _____ Part time _____

5. Over the next five years, do you expect the number of employees for your reuse or refurbishing activities to:

- _____ Remain the same
_____ Increase
_____ Decrease
_____ Don't know

6. Please check (√) the definition(s) below that best describes your company's operations.

- Non-profit Organization - Organization that takes used electronics, and either fixes them and/or distributes them "as is" to schools or other institutions for little or no fee. In some cases, whole units may be sold or demanufactured.
- Repair Shops/Retailer - Company that fixes used electronics for direct resale to consumers - generally small, family-run operations.
- Remanufacturers - Company that builds whole unit electronics from individual components, or rebuilds electronics for resale to consumers, retailers or brokers.
- Demanufacturer - Company that demanufactures used electronics for resale of individual components, and may sell workable whole units "as is" to brokers or retailers, or do nominal refurbishing of whole units and then sell them to brokers or retailers.
- Asset Recovery – Company that bids on surplus property from government and large companies, and may remanufacture, demanufacture and/or sell units “as is”.
- Broker - Company that buys and sells whole unit electronics

7. What percentage of your business is the resale of reused or refurbished whole unit electronics or electronic components? (If you have more than one facility, please provide us with the combined total percentage.)

Whole Units _____% Components ____%

B. INCOMING MATERIALS

What items do you accept at your facility(ies)? Please check each appropriate material and specify the conditions for acceptance (e.g., only “working” televisions, or >486 processing speed for computers).

Materials	Check Items Accepted (√)	Required Specifications
CPUs		
Keyboards		
Computer Monitors		
Laptops		
Hard Drives		
CD Drives		
Disk Drives		
Mother Boards		
Televisions		
Other (Explain)		

2. What percentages of the total used electronics that you receive come from the following sources:

Northeast Recycling Council, Inc. (NERC) Used Electronics Market Study Analysis

Appendices

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- Businesses _____ %
- Private Companies _____ %
- Individuals _____ %
- Institutions (e.g., hospitals, schools, etc...) _____ %
- Government Agencies _____ %
- Charitable and Non-profit Organizations _____ %
- Other (*Please specify.*) _____ %

3. **Do you provide transportation of materials to your facility(ies)?**
 Yes No

4. **For units or components destined fro reuse, do you charge for?**
 Diagnostics Testing
 Recycling/Disposal Services
 Data Removal

5. **Rank each of the following criteria on a scale of 1 to 5 for determining which of these is most important to the economic feasibility of reuse or refurbishment of whole unit electronics (1 being the least important and 5 being the most important).**

- _____ Age of Unit
- _____ Speed of Unit (RAMs)
- _____ Memory of Unit
- _____ Physical Condition of Unit
- _____ Brand Name
- _____ Cost to Refurbish
- _____ Operating System (MAC or IBM compatible)
- _____ Other (*Please specify.*) _____

6. **Are the parts used to refurbish whole units taken from other used electronics, or are they new?**
 New Used Both

Comments: _____

7. **Is it a standard practice to wipe the hard drive clean prior to resale?**
 Yes No

8. **Is operating software provided on the reused or refurbished units that you sell?**
 Yes No

Comments: _____

C. OUTGOING PRODUCTS

1. Over the past year, what percentage of the demand for your used or refurbished units has been domestic and what percentage has been foreign?

_____ % Domestic _____ % Foreign

2. What country(ies) do you export to, given market opportunities?

3. What percentage of your sales or donations is attributable to the following customer categories?

- Businesses _____ %
- Individuals _____ %
- Institutions (e.g., hospitals, schools, etc...) _____ %
- Government Agencies _____ %
- Charitable and Non-profit Organizations _____ %
- Other (*Please specify*) _____ %

4. Please complete the table below for reused or refurbished materials that your company sells or donates.

Item	Fees You Charge		Total Amounts of outgoing materials on an average annual basis over the past two years (indicate tons, units, or yd ³)
	For incoming materials	For outgoing materials	
CPUs			
Keyboards			
CRTs			
Laptops			
Hard Drives			
CD Drives			
Disk Drives			
Mother Boards			
Other Component Boards			
Televisions			
Other			

4. For the items you sell or donate, do you provide any form of?

- Take Back Program Yes No
- Discount or Rebate System Yes No
- Warranties Yes No
- Technical Support Yes No

If yes, to any of the above options, please explain. _____

6. Do you think the reuse market place has economic growth potential?

Yes No

Comments: _____

Thank you for taking the time to answer these questions. If you have any questions or comments, please feel free to contact Mary Ann Remolador [maryann@nerc.org].

Appendix 2. Survey Respondents' Profiles

A. Non-profit Respondents' Profiles					
Respondents	Years in Operation¹	# Full-time Employees²	# Part-time Employees	% Gross Sales Whole Unit Electronics	% Gross Sales Electronic Components
1	4	1	0	99	1
2	4	10	10	0	0
3	6	40	10	75	25
4	8	5	1	98	2
5	10	-	-	100	0
6	10	35	5	90	10
7	13	3	1	0	0
8	19	9	2	0	0
9	50	40	17	0	0
10	70	-	-	0	0
11	75	98	0	100	0
	24 Average	7 Average	6 Average	51% Average	3% Average

¹ The survey question asked for the total years in business, not just the number of years in the electronics reuse business.

² The survey only referred to those employees working in electronics reuse.

B. For-profit Respondents' Profiles

Respondents	Years In Operation	# Full-time Employees	# Part-time Employees	% Gross Sales Whole Unit Electronics	% Gross Sales Electronic Components
1	2	2	0	95%	5%
2	2.5	7	2	5%	25%
3	3	28	0	15%	5%
4	3	2	2	80%	20%
5	4	22	33	40%	60%
6	4	0	0	100%	0%
7	5	20	0	95%	5%
8	6	15	-	14%	1%
9	7	15	1	40%	60%
10	7	15	4	10%	10%
11	7	4	5	19%	12%
12	8	1	2	100%	0%
13	8	4	2	50%	50%
14	9	2	-	40%	60%
15	10	7	8	0	100%
16	11	16	0	0%	100%
17	13	20	6	60%	15%
18	13	20	6	60%	15%
19	14	20	5	75%	25%
20	18	10	3	5%	0%
21	25	0	0	20%	80%
22	60	153	0	2%	1%
23	85	50	150	5%	15%
	14 Average	19 Average	10 Average	40% Average	29% Average

Appendix 3. Materials Accepted, Required Specifications & Fees Charged

A. NON PROFIT ORGANIZATIONS

Accepts CPUs		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees	Selling Price
11	100%	\$3 each	\$0 each
		\$0 each	\$0 each
		\$0 each	\$5 - \$425 each
		\$0 each	\$75-200 each
		\$10 each	\$40 - \$249 each

Required Specifications

- Pentium IIs or better
- Pentiums or newer (2 responses)
- Only working Pentiums or higher
- 386 MHz and above
- 266 MHz/with CD ROM
- >486 MHz
- 166 MHz processing
- None

Accepts Keyboards		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees	Selling Price
9	82%	\$0.25 each	-
		\$0 each	\$0 each
		\$0 each	\$0 each
		\$0 each	\$1 - \$5 each
		-	\$3.50 each

Required Specifications

- Only working units
- Must work, no missing keys, PS2 connection
- With Windows key
- PS/2 connections
- None

Accepts Monitors/CRTs		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees	Selling Price
10	91%	\$7 - \$10 each or \$0.12-\$0.15/lb	-
		\$0	\$0 each
		\$0	\$15 each
		\$0	-
		\$10 each	\$10 each

Required Specifications

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- Only working units (4 responses)
- Working, VGA or SVGA, 15" or larger
- 1999 or newer, 15" or larger
- No Tandy brand
- None

Table 4. Laptops			
Accepts Laptops		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees	Selling Price
10	91%	\$10 each	-
		-	\$0 each
		-	\$0 each
		-	\$50 - \$200 each

Required Specifications

- Working Pentiums or newer
- Pentiums that need minor repairs
- Pentiums or newer
- Working 300 MHz or better processor
- > 486 MHz
- None

Table 5. Hard Drives			
Accepts Hard Drives		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees Charged	Selling Price
8	73%	\$0 each	\$0 each
		\$0 each	\$5 - \$25 each
		\$0 each	\$5 - \$15 each

Required Specifications

- Must be working, if not part of CPU
- 4 gigabytes or more
- Functional, minimum of 1.2 gigabytes
- > 1 gigabyte
- None

Table 6. CD Drives			
Accepts CD Drives		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees Charged	Selling Price
8	73%	\$0 each	\$0 each
		\$0 each	\$10 each
		\$0 each	\$20 each

Required Specifications

- Must be working, if not part of CPU
- Working, minimum of 24x speed
- None

Table 7. Disk Drives	
Accepts Disk Drives	Fees Charged

# Non-profit	% Non-profit	Incoming Fees Charged	Selling Price
8	73%	\$0 each	\$0 each
		\$0 each	\$5 each

Required Specifications

- Must be working, if not part of CPU
- None
-

Table 8. Motherboards			
Accepts Motherboards		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees Charged	Selling Price
5	46%	\$0 each	\$0 each
		\$0 each	\$5 each

Required Specifications

- Must be working, if not part of CPU
- 486 MHz +
- None

Table 9. Component Boards			
Accepts Component Boards		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees Charged	Selling Price
4	36%	\$0 each	\$0 each

Required Specifications

- None

Table 10. Televisions			
Accepts Televisions		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees Charged	Selling Price
6	55%	\$0 each	\$0 each
		\$0 each	\$5 - \$30 each
		\$4.50 each	\$30 - \$150 each
		\$12 - \$15 each	-

Required Specifications

- Must be working
- Color and in good working order
- JVC Brand only
- 15 years old or younger
- None

Accepts Other Electronics		Fees Charged	
# Non-profit	% Non-profit	Incoming Fees Charged	Selling Price
5	46%	\$0 each	\$0 each
		\$5 (printers) each	-
		\$5 (faxes) each	-
		\$25 (copiers) each	-

Other Electronics Accepted

- Printers, faxes, copiers, networking equipment
- Working laser and ink jet printers
- Functional speakers, laser or color inkjet printers

B. FOR-PROFIT COMPANIES

Accepts CPUs		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
22	96%	\$0	-
		\$0	\$.10/lb
		\$0	\$1 - \$30 each
		\$0	\$100 - \$300 each
		\$0 - \$5 each	\$0 - \$200 each
		\$0.30 - \$7.50 each	-
		\$1.50 each	\$5 - \$100 each
		\$6 each	-

Required Specifications

- None (7 responses)
- Must be palletized
- < 266 gets dismantled
- Working and/or > Pentium II/233 MHz
- Scrap quality and higher

Accepts Keyboards		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
21	91%	\$0	\$0
		\$0	\$0.15/lb
		\$0	\$1 - \$30 each
		\$0.05/lb	-
		\$0.10 - \$0.30/lb	-
		\$0.15 - \$0.21/lb	\$0 - \$1 each
		\$0.20/lb	
		\$0.50/lb	

Required Specifications

- None (7 responses)
- Working and complete
- Gaylord boxed

Table 14. Monitors/CRTs			
Accepts Monitors/CRTs		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
21	91%	\$0	\$20 - \$100 each
		\$0 - \$20 each	\$0 - \$100 each
		\$0.30 - \$9 each	-
		\$3 each	\$6 each
		\$7.50 - \$15 each	\$5 - \$100 each
		\$8 - \$15 each	\$1 - \$150 each
		\$8.50 each	-
		\$10 each	-
		\$10.50 each	-
		\$15 each	-\$5 each

Required Specifications

- None (5 responses)
- 14,15, 17" SVGAs
- Packaged in boxes
- Unbroken

Table 15. Laptops			
Accepts Laptops		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
21	91%	\$0 - \$1.68/lb	\$0 - \$100 each
		\$0.40/lb	\$5 - \$100 each
		\$0.80 - \$2.40/lb	-
		\$1.60/lb	-
		\$4 each	\$25 each
		-	\$5 - \$1,000 each
		-	\$120 - \$300 each

Required Specifications

- Working & complete, ≥ P-1, 166 MHz
- Gaylord boxed
- None (7 responses)

Table 16. Hard Drives			
Accepts Hard Drives		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
22	96%	\$0	-
		\$0	\$3 each
		\$0	\$1 - \$300 each
		\$0 - \$0.21/lb	\$0 - \$50 each
		\$0.05 per/lb.	-
		\$0.10 - \$0.30/lb	-
		\$0.50 lb	\$0 each

Required Specifications

- Working
- Gaylord boxed
- None (7 responses)

Table 17. CD Drives			
Accepts CD Drives		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
2	91%	\$0	-

Required Specifications

- Working
- Gaylord boxed and palletized
- None (6 responses)

Table 18. Disk Drives			
Accepts Disk Drives		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
20	87%	\$0 each	\$0 each
		\$0 each	\$1 - \$5 each
		\$0 each	\$3 each
		\$0 each	\$10 each
		\$1 each	-
		\$1 - \$300 each	-

Required Specifications

- Must be working, if not part of a CPU
- Gaylord boxed and palletized
- None (6 responses)

Table 19. Motherboards			
Accepts Motherboards		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
20	87%	\$0	-
		-	\$0 each
		\$0	\$0.15/lb
		\$0 - \$0.50/lb	\$1 each
		\$0.05 /lb	
		\$0.10 - \$0.30/lb	
		\$0.50/lb	

Required Specifications

- Must be working, if not part of a CPU
- Gaylord boxed and palletized
- None (6 responses)

Table 20. Component Boards			
Accepts Component Boards		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
20	87%	\$0	-
		\$0	\$0.045/lb
		\$0.05 per/lb	-
		\$0.10 - \$0.30/lb	-
		\$0.15 - \$0.21/lb	\$0 - \$100 each
		\$0.50/lb	\$0.25/lb

Required Specifications

- Must be working, if not part of a CPU
- Gaylord boxed and palletized
- None (6 responses)

Table 21. Televisions			
Accepts Televisions		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
13	57%	\$0 each	\$0 each
		\$2.25 - \$9.45 each	\$35 - \$100 each
		\$4.50 each	\$6 each
		\$8 - \$15 each	-
		\$10 each	-
		\$10 – 15 each	-
		\$15.75 each	-
		\$22.50 each	-\$10 each

Required Specifications

- Unbroken
- None (4 responses)

Table 22. Other Electronics			
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Accepts Other Electronics		Fees Charged	
# For-profit	% For-profit	Incoming Fees Charged	Selling Price
18	78%	\$0	-
		\$0	\$100 - \$400 each
		\$0.01/lb	\$0.02/lb
		-	\$5 - \$250 each

Other Types of Electronics Accepted

- Any computer related products
- Anything or most electronic in nature (3 responses)
- Cables
- Copiers (3 responses)
- Fax machines
- Laser and color inkjet printers
- Mainframes
- Manufacturers scrap
- Medical equipment (3 responses)
- Midrange equipment
- Networking equipment
- Printers - working and complete
- Servers and storage devices
- Telecommunications Equipment
- Telephone systems from telephone companies
- UPS surge protectors
- Voice and data equipment

Appendix 3. Calculations for Greenhouse Gas Emission Savings of Reused Whole Unit Computers

BTU Savings

Million BTU/ton savings = total tons of used whole unit computers x 957.27million BTU/ton

Source: U.S. EPA, Office of Solid Waste, 2003. *Waste Reduction Model*. Washington, D.C.

BTU Equivalents - Energy Conversion Factors

Total Barrels of Oil Saved = million BTU/ton savings ÷ 5.8 million BTU

Total Gallons of Oil Saved = total barrels of saved oil x 42 gallons oil

Total Gallons of Gas Saved = million BTU/ton savings ÷ 0.125 million BTU

Reduced Cars from Road/Year = total gallons of saved gas ÷ 556 gallons gas

Reduced Car Emissions (CO₂ tons/year) = total number of reduced cars from road x 5 tons CO₂

Source: U.S. EPA. *Waste Management and Energy Savings: Benefits by the Numbers*. Washington, D.C.