Understanding and Examining the Impacts of Orphan Products and ‘White Box’ Products on Emerging Electronics Recycling Systems

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Abstract—This paper explores the data and methodology for improved identification of orphan products that are collected in electronics recycling programs, and reviews and recommends options for better identification and incorporation of products from "white box" manufacturers covered by various existing and proposed electronics recycling systems.

Keywords—electronics recycling policy, infrastructure

I. INTRODUCTION

This paper is a result of project of the National Center for Electronics Recycling (NCER) and input from an NCER multi-stakeholder project committee established to exchange information about “orphan” and “white box” products as viewed through the lens of electronics recycling systems. Orphan products are generally defined as a waste for which a manufacturer cannot be identified or waste for which its manufacturer is no longer in business. White box products are defined by PCMag.com as “another term for a PC clone” (although less commonly other IT products such as monitors and laptops also may be called “white box”). Both of these types of products have been the subject of much debate in the planning and establishment of electronics recycling systems. The purpose of this report is to shed light on what orphan and white box products are, how they impact recycling systems and provided suggestions and analysis on how the process for identifying these products could be improved.

The larger goal of the NCER’s work on orphan and white box products is to identify possible information-based approaches to support a more “level playing field” for all producers of electronics subject to new recycling requirements. Identification of viable approaches will help shape development of policies for managing end of life electronics.

1 http://www.pcmag.com/encyclopedia_term/0,2542,t=white+box&i=54431,00.asp

A. National Center for Electronics Recycling

The NCER is dedicated to the development and enhancement of a national infrastructure for the recycling of used electronics in the U.S. through 1) the coordination of initiatives targeting the recycling of used electronics in the United States, 2) participation in pilot projects to advance and encourage electronics recycling, and 3) the development of programs that reduce the burden of government through private management of electronics recycling systems.

The NCER was formed in February 2005 as a non-profit organization in Davisville, West Virginia. The NCER has received seed funding from a grant supported by EPA and the Department of Energy funds known as the Mid-Atlantic Recycling Center for End-of-life Electronics (MARCEE) Project. In addition to its Board of Directors, the NCER is guided by a 12-member Industry Advisory Committee of manufacturers who are the leaders in the environmental field. By the end of 2005 the NCER had also received generous grant support from the Consumer Electronics Association and the West Virginia High Technology Consortium Foundation.

B. Reasons for Project

An initial NCER activity was a survey of the NCER Industry Advisory Committee to determine which projects held priority for developing the national infrastructure. Activities were selected for their potential to solve important challenges in the current or developing electronics recycling systems, be scalable to benefit a potential national system, and be supported by industry regardless of any policy position on system financing. The Orphan/White Box Analysis was deemed a priority for the majority of responding manufacturers due critical knowledge this research could provide for ensuring a level playing field in electronics recycling regulations.
As of early February, 2006, one state – Maine – had passed and begun implementation of an electronics recycling law that required identification of orphan products. On the white box side, the state of California has a law in place that requires payment of an Advance Recycling Fee at point of sale for all new cathode ray tube (CRT) devices (TVs and computer monitors), laptop computers, LCD computer monitors, LCD TVs, and plasma TVs. Depending on the specifics of the chosen electronics recycling system design, these and other systems under consideration may need to properly identify and account for products classified as orphans and ensure the participation of white box products.

Orphan products and white box computers impact both of the dominant approaches to financing electronics recycling systems. Both of these product types represent an unknown, but significant, portion of the overall amount of electronic devices to be reused and recycled over the next several years. In producer responsibility systems where costs are based on returned products, such as Maine, orphans affect all companies currently in business whose brands are returned for recycling. If a company or its successor cannot be found for a particular returned brand, the cost of recycling that brand is borne proportionately across current and compliant market players. In an advanced recycling fee system, such as in California, orphans are not a concern since their recycling costs are typically covered by the recycling fund that finances recycling regardless of product brand. However, white box computers, which are traditionally assembled by small to medium sized companies, may escape the advance fee structure if white box producers and sellers are not properly informed and requirements not enforced.

II. OVERVIEW OF ORPHAN/WHITE BOX ISSUES

Orphan products and white box products are distinct categories of electronic devices. For the purposes of this paper, they are considered separately due to their different impacts on recycling systems.

A. Importance of Orphans

This research is intended to provide information for developing programs for reusing and recycling used electronics. Many of the current debates on electronics recycling systems focus on who pays, and how much, and orphan issues are a major consideration in ensuring a “level playing field” for all parties designated as responsible for financing recycling and related activities.

1) Relevant U.S. Policies on Orphans

The California electronics recycling law 2 creates an advanced recycling fee (ARF) of $6, $8, or $10 that is paid by the consumer at the point of sale. Under their program, the only devices covered by the ARF and eligible for reimbursement for recycling-related services are: cathode ray tube (CRT) devices (TVs and computer monitors), laptop computers, LCD computer monitors, and as of July 2005 LCD and plasma TVs. The California law has no provision for orphan products, and funds collected for recycling are utilized for all returned covered electronic devices regardless of the original producer.

The Maine program also covers TVs, computer monitors and laptop computers under a law passed in 2004. Under Maine’s approach, the funding for the system is shared between product manufacturers and local governments. Local governments collect from Maine households (waste electronics generated by businesses are not covered), and deliver the collected products to a state-approved “consolidator.” These consolidators count the number of brands from each manufacturer, and then send each manufacturer a bill for the amount that their brands represent plus an additional amount for “orphan” products whose original manufacturer no longer exists and no successor can be found. The chart in Table I shows the legal definition of orphans under the Maine law. The Maine Department of Environmental Protection (DEP) was charged with determining each manufacturer’s “pro rata share” of orphan waste. The only guidance provided in the statute for DEP in determining this share is that the share must be based on available data, including those submitted by manufacturers.

The Maryland law established a five-year pilot program for recycling desktop computers, laptops, and computer monitors that began on January 1, 2006. Under the program, manufacturers of these products must register with the State and pay an annual $5000 fee. If the manufacturer implements a take-back program, the fee is reduced to $500 after the first year. The collected registration fees go into a state recycling trust fund that can be used by local governments to fund collection and recycling programs. Like California, the Maryland program makes no provision for orphans since it does not attempt to determine financial responsibility for recycling at the time of disposal.

2) Definitions in Legislation

The following chart outlines a few of the existing definitions of “orphan” product that are currently in use – both in existing law and pending electronic recycling legislation as well as in other electronic recycling initiatives.

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<th>TABLE I. ORPHAN DEFINITIONS</th>
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2 See: http://www.ciwmb.ca.gov/Electronics/Act2003/
B. White Box Definitions and Overview

White box products present similar but unique challenges to electronics recycling systems. Both orphans and white box products in electronics recycling require an investigation into the original manufacturer or brand owner in order to assign some type of responsibility (i.e. collect/remit a recycling fee, or take responsibility for a share of returned products).

There is no official definition of a white box product or manufacturer, and the companies within the industry do not endorse the term. Alternative names for these companies include “value-added reseller” and “system builder.” Traditionally desktop and laptop computers, white boxes have unofficial definitions such as products with a no-name brand from a non-major vendor by an assembler, or a custom-built computer with name-brand internal components.

For many years, white box companies have represented a significant portion of the computer market. Many estimates place white box sales in the 25-35% range for desktops, and just under 10% for laptops. The traditional white box maker is a small to medium sized enterprise that is able build to customer specifications in smaller quantities. Because the brand is not the main selling point for these systems, these builders would many times use off-the-shelf components and computer housings without a brand label—hence the name “white box.” As explained in the next section, this presents a problem for electronics recycling systems in that a brand label provides a basis for assigning responsibility, and without it, these products could be misclassified as orphans.

1) Relevant U.S. Policies for the White Box Market

California does not specifically reference white box makers or products in their electronics recycling law. However, white box makers are no longer allowed to sell a covered product in the state if it is not labeled with the name of the manufacturer or the manufacturer’s brand label. In addition, white box sellers must collect the fee and remit it to the state Board of Equalization for any covered product. Since the California law does not cover desktop computers, the greatest impact of this requirement would be for laptop computers sold by white box builders or any theoretical white box branded monitors or TVs.

In Maine, a white box manufacturer would be responsible for any of its laptops that are returned to the designated consolidators. However, because a typical laptop has a lifespan of seven years, many of the white box laptops returned in Maine for the next several years may not be charged to white box manufacturers if a brand label was not originally used. Indeed, in the NCER Brand Sort Reports for laptops, “unknown” ranks sixth in return share accounting for approximately 4% of all laptop returns. Maine no longer allows the sale of a covered device unless a visible, permanent label clearly identifying the manufacturer of that device is affixed to it. This labeling requirement also applies to desktop computers even though manufacturers are not currently responsible for funding the recycling of these products.

The requirements in Maryland are unique with respect to white box manufacturers. Under their program, manufacturers of desktop computers, laptop computers, and computer monitors are required to submit a registration to the State if they manufacture more than 1000 of those items per year (but not necessarily sold solely in Maryland). If a white box manufacturer meets this threshold of 1000 per year manufactured, that company would have to submit the annual $5000 registration fee or implement a takeback program and submit a reduced fee. Like California and Maine, manufacturers of covered products are required to label the product with the manufacturer’s name or the manufacturer’s brand label.

2) Definitions in Legislation

As of the writing of this paper there is legislation in the Washington State legislature that would cite white box manufacturers in an electronics recycling statute for the first time. Senate Bill 6428 defines a “white box manufacturer” as “a person who manufactures unbranded covered electronic products offered for sale in the state within ten years prior to a program year for televisions or within five years prior to a program year for desktop computers, laptop or portable computers, or computer monitors.” The legislation places restrictions on the ability of these manufacturers to employ a recycling program independent of the “standard plan” established for most producers of covered electronics.

III. Project Overview

This section provides an overview of the process and methodology used for this research. This paper represents the tasks and conclusions of the overall project as of February 2006. The NCER will be accepting more feedback from stakeholders and issue a final report based on the findings presented here.

A. Multi-stakeholder Project Committee

The NCER organized a multi-stakeholder project committee in April 2005 to provide input into the work plan and research needed to complete this project. Thirty representatives of state government, local government, manufacturers, recyclers, and Non-Governmental Organizations (NGOs) signed up to participate in the project committee. The Project Committee held created several work products that were critical to the research presented in this paper, including 1) an Orphan Decision Tree (see Figure 1 below); 2) a matrix of orphan definitions (see Table 1 below); 3) National Return Share Estimates for Monitors, TVs, Desktop Computers, and Laptop Computers; and 4) a list of the top ten brands not claimed in Maine. In addition to revising these documents, the project committee participants

3 Laptop figure from interview with Doug Daniel, NASBA the Association of Channel Resellers, September 1, 2005.
5 www.electronicsrecycling.org/cdr/BrandSorting.aspx
6 http://www.electronicsrecycling.com/NCER/UserDocuments/Top%20ten%20brands%20not%20claimed.xls
exchanged information on the history of brands that were potential orphans.

B. Methodology Used for National Return Share Estimate

The NCER Brand Sort Reports use four sources of recent brand counts from around the United States: 1) Florida Electronics Brand Distribution Study (December 05 Updated Reports); 2) Hennepin County “Consumer Electronics Brand Tally” (2004); 3) Good Guys Electronics Take-back Pilot Project (2004, Washington State); and 4) Staples Reverse Distribution Pilot (2004, New England states).

Each of these sources provided data on brands of returned electronic products. When available, data from each program were compiled for televisions, monitors, desktop and laptop computers. While the data across all four sources was generally compatible, differences across program data definitions such as unit size and discrepancies in the data itself (e.g., brand names) were harmonized manually by the NCER and published in the first NCER National Return Share Estimates in July, 2005. Additional data were provided by the Florida program through December, 2005 and updated NCER Brand Sort Reports were published in February, 2006.

The number of total returned units varied substantially across different programs with Hennepin County providing the largest sample size and the Staples Pilot the smallest. For example, by the time of the February 2006 update Hennepin County reported 12,827 monitor units and brands, Florida 7,850 and Staples 1,090 (the Good Guys Pilot did not collect monitor data).

A review of program-specific brand data revealed variations in return volumes across programs. For example, across the 3 programs reporting monitor data the largest single returned brand of monitors was “Apple.” When associated brands were combined (“Apple,” “MAC,” “MacIntosh” and “iMac”), these Apple products comprised 4.9% of the total monitor returns in the Florida program, 11.6% in Hennepin County, and 18.8% in the Staples Pilot. While the relatively small sample size in the Staples Pilot could help explain the relatively larger proportion of Apple product reported in that pilot, the large difference between Hennepin County and Florida suggests that regional variations for even large volume brands of returned electronics may be substantial.

National return share estimates were developed by the NCER by averaging the return shares of each brand specific to that program. This was done to minimize regional differences that could be exacerbated by a single, large sample (e.g., Hennepin County). In the Apple monitors example described above, the NCER national return share estimate for Apple monitors is the un-weighted average of 4.9%, 11.6% and 18.8% -- or approximately 11.75%. This return share estimation methodology differs from the one employed by the state of Maine to implement that state’s electronics recycling program. In the Maine program, return share estimates were developed adding unit counts across programs. Using the Maine methodology of summing units across programs, Apple’s return share estimate would drop to 9.5% (2,075 total Apple units out of 21,767 total monitor units). The NCER does not make any assertion as to the superiority of either method but notes the difference as a major reason for differences between return share estimates reported by Maine and the NCER Brand Sort Reports.

C. Coordination with State of Maine

Representatives of the Maine DEP were active participants in the NCER Multi-stakeholder project committee and provided data and insights into their process. Because Maine is the first state to attempt to identify and analyze orphan electronic products, the DEP process serves as a de facto model for any future program requiring orphan determinations. While this paper does not attempt to explain why the DEP made particular decisions on orphan determinations, it is helpful to review two key aspects of their analysis.

First, the DEP published a list of manufacturers/brand owners and brands for which they were deemed responsible. The DEP developed the list of brands for which manufacturers are deemed responsible using available data and reference sources with information on brand history and ownership, such as the “The Thomas Register”, “Gale Trade Name Directory”, “Headquarters USA”, “Dun and Bradstreet Industry Handbook”, trade association directories, and similar resources. If a brand was not claimed by a manufacturer and the DEP could not find a successor in the reference books or through other research, and the DEP found evidence that the most recent responsible manufacturer went out of business with no successor in interest, the brand was deemed an orphan according to the statutory definitions. Since the consolidators will need to track all brands that are received at their facilities, this approach allows them to know which brands should be billed to manufacturers, and which brands to manage as orphans. If a brand is not found on the list, the consolidator notifies the DEP, and the DEP will perform research on that brand to make a determination whether there is a viable manufacturer or the brand is an orphan.

Second, in their regulations to implement the law, in determining pro rata share responsibilities for the management of the orphan waste, the DEP decided to allow for “de minimis” shares. For these brands or manufacturers, which may each represent no greater than 1% of the television or monitor waste stream, there is no orphan share for which they are financially responsible. To put this 1% threshold in context, according to the NCER Brand Reports there are 24 different television brands representing at least 1% of the total television returns, and these 24 brands constitute approximately 86% of all returned televisions in 2004-2005. For monitors there are 16 brands representing 1% or more of total monitor returns, and these 16 brands represent approximately 73% of all returned monitors. And there are 14 brands of laptops

7 http://www.dep.state.fl.us/waste/categories/electronics/pages/Floridaelectronicproductbranddistributionproject.htm
8 http://www.co.hennepin.mn.us/vgn/images/portal/cit_100003616/4019/121541970/Hennepin_Brand_Tally.pdf
representing at least 1% of the total laptop returns, representing approximately 89% of all returned laptops. Note that the NCER Brand Reports use a slightly different methodology than Maine in determining brand shares as described in III (B) above, and the actual number of brands assigned orphan shares in Maine may differ slightly from these estimates.

D. Determining Potential Orphans

During the summer of 2005, the NCER developed a generic orphan decision tree methodology to illustrate a logical orphan determination process.

![NCER Orphan Decision Tree](image)

As Figure 1 illustrates, the first step in an orphan determination is “Can the producer or product brand owner be identified?” Although framed as a simple question, the word “can” is an inherently contextual term that suggests not only the question of the continuing existence of the producer/brand owner (current and/or historic), but also the ability and determination of the authority responsible for finding the producer/brand owner. This nuance underscores the observation that the term “orphan” may be applied to a broad set of widely differing scenarios that ultimately result in the absence of financial responsibility for returned products. Several possible orphan scenarios are discussed below.

**Orphans whose brand owners were not contacted.** As discovered by Maine and as shown in the NCER Brand Sort Reports, literally hundreds of different brands of products are returned by consumers in each product category. The vast majority of these brands are associated with very small quantities of products, representing much less than 1% of the total returns. Officials responsible in Maine for identifying manufacturers of historic products recognized that attempting to track down the owner of every single returned brand may not be possible nor cost effective. Many of these brands theoretically “could” be identified by authorities in Maine, but in practice the manufacturers representing approximately 2% of all television return shares and 4% of all monitors return shares -- a total of 142 brands -- have yet to be identified and mailed a request to assume responsibility. These brands may be deemed to be “orphan.” Thus one strain of orphan products: de minimis orphans.

**Non-responsive manufacturers.** Of the manufacturers who were mailed a request to claim responsibility for historic/returned brands, no response was received from producers representing approximately 1% of all television returns and approximately 2.5% of all monitor returns, which represents a total of 68 manufacturers. Non-respondents fall into one or more of the following categories:

The non-compliant producer/brand owner is a company that continues to produce these or similar products, and does not dispute its historic ownership of a covered electronic product but does not submit the required plan and refuses to accept responsibility for paying for their products returned in Maine. Maine DEP considers these to be “abandoned waste”, and has the enforcement authority to seek triple cost damages from the responsible manufacturer for non-payment of costs allocated to the manufacturer in accordance with Maine’s E-Waste Law. These would be considered non-compliant orphans.

Some companies may no longer produce those products due to the divestiture of that product line to another company or the abandonment of that business altogether. In other cases brand ownership may have changed one or more times, raising questions as to which producer is responsible for brands of different vintages. These are examples of non-responsive producers would fall under the category disputed brands and as such may or may not ultimately be claimed. Note that the investigative resources available to the authorities responsible for determination of manufacturer responsibility is a primary factor in whether brands in these categories end up categorized as orphans.

Identification of brand names is a manual process that inevitably includes some margin of error at the points of brand identification, brand data entry and brand data management. For example, managers of the landmark Florida Recycled Electronic Brand Distribution Project estimate that their data entry error is <5%. Officials in Maine estimated that approximately 3% of the televisions and monitor brands in their datasets were “mis-identified.” Thus brands incorrectly identified at some point in the information chain are false orphans.

For some brands the company and brand have ceased to exist, the product line was discontinued and there was no successor for that brand/product line. These are true orphans. Conclusive determinations of true orphans can be relatively difficult, however, given that such a determination is made only upon comprehensive review of available information to determine either the absence of proof or the presence of any conclusive information such as legal documentation of bankruptcy.

It is important to note that these potential orphan sub-categories may and do overlap for any given brand, particularly

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11 These percentages rely on unpublished data by the Maine DEP that will be available at later date at: [http://www.maine.gov/dep/rwm/ewaste/](http://www.maine.gov/dep/rwm/ewaste/)

12 See footnote 11

over time. Since at the root an orphan determination is a regulatory determination, perhaps a better term than “orphan product” would be “unclaimed product.” These subcategories are intended to provide insight into the range of reasons why producers and/or their successors do not ultimately take financial responsibility for their returned products.

E. Brand Data Management

The NCER employed a set of data management tools and technologies to gain more insight into the data compiled for the NCER brand reports and better analyze the impact of orphan products. New tools were necessary to manage the hundreds of different brands reported by existing brand return share studies in order to develop a data management methodology that would allow a better breakdown and closer examination of the influence orphan products have on existing and proposed electronics recycling systems. These data management tools provide an in-depth look and data “dashboard” resulting in a finer detailed comparison of brand data, including measuring variations in brands appearing across return share studies, brand ranking trended over time (including changes of top brands collected), and the information necessary to aid in future projections of orphan cost and return share for monitors, TVs, desktop computers and laptop computers.

This Brand Data Management System (BDMS) captures vital information from individual brand sort efforts such as the Florida Electronics Brand Distribution Study and the Hennepin County Consumer Electronics Brand Tally, among others, and could serve as the back office data management system for a national clearinghouse of returned brand data. This system includes the development of a standardized brand nomenclature to allow improved analysis of brand data across return share studies. The BDMS’s reporting features offer insightful views of the data including brand return rankings over time, brands identified as orphans by regulatory authorities, and relationships between brand owners and their historic producers all presented by brand, manufacturer and/or by product type.

These tools are designed to illuminate the issues confronted by electronics recycling systems that utilize return brands as a primary component in financing electronics recycling. The tools serve an essential role in the building and maintenance of a national clearinghouse containing historic brand ownership records and the electronics recycling-related regulatory decisions associated with those brands.

IV. Lessons Learned

There are several conclusions that the NCER can draw from this research that will aid in the development and planning for future electronics recycling systems. The first overall conclusion is that white box and orphan products exhibit similar characteristics for electronics recycling systems, but have different impacts depending on the financing mechanism and regulatory structure of a particular program.

Second, before white box or orphan products can be identified, it is essential to have clear and detailed definitions. Historically the term “white box” has been used as an informal industry descriptor covering a broad range of product sales channels for computers and monitors; however, recent state legislation is attempting to codify this term into statutory language to describe producers of covered electronic products that lack a brand. For orphans, determining which brands are orphan products is mainly a matter of meeting a regulatory definition. As such, it is a task best suited for a government agency that can handle the inevitable disputes and enforce against noncompliant companies with the threat of penalties.

Third, information on current brand ownership of historic/return products is not readily available for all brands. Improved brand/producer identification procedures are required to bring producers of “de minimis” quantities of products into financing systems similar to Maine’s. The lack of viable identification mechanisms for very small producers has required electronics recycling systems to exempt brands representing a “de minimis” share of returns from orphan liability. Furthermore, without better brand/producer identification it is doubtful that many of these small producers will ever be found and billed when their products are returned into systems premised on return share liability. This paper did not research and therefore makes no conclusions about manufacturer compliance rates with orphan and related regulatory requirements once brand ownership is established.

The final conclusion is the observation that the data on which to base brand return share and orphan share are limited in both quantity and geographic coverage. These limited data demonstrate regional variations in product returns for individual brands. Thus, small changes in source data and the methodology for developing a particular brand’s return share can produce significant variations in a manufacturers’ financial responsibility in electronics recycling systems which account for orphans. Regional variation in brand returns was not explored in this research, but could be due to factors such as: stronger manufacturer-retailer relationships in certain regions, passing down of school system computers to households in one area, or region-specific brands of white box products.

One possible project that would build on this research and the work of the Maine DEP would be the creation of a national clearinghouse of historic brand ownership to collect, analyze and share this relevant commercial information. Building on the Brand Data Management System described in Section III (D) , this clearinghouse could provide a resource for standardized brand names (e.g., “J.C. Penney” or “JC Penney”?) to facilitate better management of return share and orphan share data.

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