WPI

Electronic Waste Recycling Legislation in Massachusetts

An Interactive Qualifying Project submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor Science

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ABSTRACT

Twenty-six states have laws that require the recycling of electronic products, or E-Waste. The consumer usually absorbs the cost of recycling E-Waste, although Extended Producer Responsibility (EPR) makes producers financially liable for recycling. In Massachusetts, E-Waste is the fastest growing category of waste. Currently, there are three E-Waste recycling bills before the Senate Ways and Means Committee. Working in conjunction with Senator Eldridge's office, we promoted the passage of an E-Waste bill by educating the public about recycling and advocating for support of a comprehensive EPR bill.

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EXECUTIVE SUMMARY

Electronic waste, otherwise known as E-Waste, is a category of surplus electronic goods that are no longer wanted or useful, often considered to be "end-of-life" electronics (Bouvier 2011). Many hazardous chemicals such as beryllium, cadmium or lead are found in E-Waste and cause various types of cancers as well as kidney, liver, and brain damage in humans, along with other adverse ecological impacts (Cobbing 2008). In fact, E-Waste is the most rapidly growing form of waste in the Massachusetts – less than 20% of the total amount of electronic waste generated was recycled in 2008 (Greenpeace, 2008).

E-Waste may take one of several different fates when thrown away. When disposed of in the trash with other forms of garbage, E-Waste may be incinerated, thrown in a landfill or exported to third world countries. Once abroad, E-Waste is often improperly recycled by untrained workers, who do not have the knowledge or resources to dispose of E-Waste safely (Puckett, 2005). Furthermore, large amounts of the exported E-Waste is stockpiled, with no efforts to remove salvageable parts or find other useful applications for the material (Schmidt 2002). Improper recycling or disposal creates risks to human health and the environment. Despite all these concerns, recycling can be a safe and effective way of disposing of E-Waste.

Collection, the first step to recycling, is defined as the act of gathering, sorting, and packaging E-Waste for transportation and proper disposal. There are six types of collection most commonly used in the United States and internationally, including (1) curbside pick-up by collection companies with trucks, (2) donation to charitable organization such as the Salvation Army, (3) collection events hosted by recyclers, governments or private companies, (4) drop off locations at companies such as Best Buy or local municipal recycling facilities, (5) mail-in services through companies such as Apple Inc., or (6) simple disposal in the common waste stream by throwing E-Waste in the garbage. Cost and convenience are basic factors in any person's willingness to participate in a recycling program. In states that do not have a well-advertised, convenient E-Waste recycling program, consumers with the mind to recycle must spend time and money to locate, pay for, and travel to electronic waste collectors before passing their E-Waste off to be recycled.

Processing is the disassembly of E-Waste into its system components. Sometimes, a processor merely takes these electronic components and either resells them as refurbished

parts to consumers or ships them overseas to be reused. Ideally, the processor is responsible for separation of E-Waste into hazardous components, reusable parts and basic raw materials. First the product is stripped of dangerous parts, such as Cathode Ray Tubes (CRTs), which may contain up to 8 pounds of lead each (Urbina, 2013). After stripped of dangerous parts, E-Waste goes through a huge shredder. The goal of the shredder is to reduce the size of E-Waste into "uniform rough pieces" (Kirkke, 2008). These harvested materials, especially steel, glass, copper and aluminum, are resold to manufacturers to generate income for E-Waste recyclers (Kirkke, 2008). Safe recycling is considered 'high-tech' recycling in comparison to recycling through incineration (Robinson 2009). However, safe recycling almost always comes at a cost to the consumer.

In February, 2002, the 27 member countries of the European Union ratified a directive on Waste Electronic and Electrical Equipment, also known as WEEE (Ongondo, 2011). The directive requires the use of safe recycling methods. To deal with the associated cost of safe recycling, EU legislators chose to use an environmental policy known as *Extended Producer Responsibility* (EPR). The EPR model makes producers, those that create electronic products for the market, take responsibility for removing those products from the market. To do so, producers are held financially responsible for the costs of collection, transportation, and processing (Bohr, 2007). With the EPR model, producers build products that are easier to recycle and contain less hazardous chemicals.

In juxtaposition to the EPR model in the EU, the United States federal government has not passed any legislation on E-Waste. As a result, it has fallen to the states to legislate an E-Waste recycling program. The EPR model has been instituted to varying degrees in Washington, Maine and New York, among many other states. Currently in Massachusetts, there is no legislation mandating that E-Waste be recycled or that recycling be conducted in a safe manner (MassDEP, WasteBans). Massachusetts is on the verge of instituting a version of the EPR model that has the possibility to be the most innovative in the United States.

There are currently three bills in the State Legislature aimed at establishing an E-Waste recycling program in Massachusetts. Senator Jamie Eldridge sponsored S357, *An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products*. Senate bill 357 mandates an EPR model that regulates and audits each

of the members in the safe recycling process. Representative Smizik sponsored H803, which has the same title and is essentially the same piece of legislation as S357. Senator Marc Pacheco sponsored S386, *An act relative to information technology producer responsibility,* which aims to mandate an EPR-based approach to recycling E-Waste in Massachusetts. However, S386 has several definitions that could be more expansive and several provisions that could have stronger wording in order to increase the coverage of a Massachusetts E-Waste recycling program.

The goal of our project was to facilitate the passage of comprehensive E-Waste recycling legislation. First, we characterized E-Waste recycling policy at the international, national, and state levels. Additionally, we compared the purposes and attributes of previous and pending E-Waste bills in Massachusetts. Second, the team increased public awareness by educating a variety of Massachusetts residents on the issues of E-Waste and E-Waste recycling. We also surveyed these Massachusetts residents to gather data on their opinions on E-Waste recycling.

(1) Education

To raise awareness about the issue of E-Waste in the Commonwealth of Massachusetts, the team utilized Google Sites to create a website that became a repository of information for recycling and legislation. The website provides the residents of Massachusetts with educational resources on societal impacts, methods of recycling, the locations of certified recyclers and updates on legislation. Our website was able to attract over 400 visitors from across the world within a one-month time frame. We contacted an environmental advocacy group called Massachusetts Public Interest Research Group (MassPIRG) to gain access to Massachusetts colleges with high percentages of in-state students. In Worcester, our team attended the Worcester EcoTarium's Earth Day celebration to promote our project and survey visitors at the EcoTarium. The team surveyed and assisted WPI's Student Green Team with a free E-Waste collection drive on campus, where we collected over 7287 pounds of E-Waste.

To ensure introducing E-Waste legislation for the Commonwealth of Massachusetts was the correct step, the team conducted a survey involving a random sample of Massachusetts residents. In total we surveyed over 400 residents. Our data analysis showed that 87% of the surveyed Massachusetts residents supported legislation

that makes manufacturers, otherwise known as producers, financially responsible for the safe recycling of E-Waste. Also, our analysis indicated that the majority of residents do not wish to spend more than $5 per item or travel more than 5 miles to safely recycle their E-Waste. Overall the opinions of Massachusetts residents reinforced our main claim; Massachusetts needs to pass legislation for an EPR based E-Waste recycling program.

(2) Policy

To gather more insight into E-Waste legislation, the team took the time to conduct case studies on various forms of E-Waste policy, including the Europe Union, Washington State, California, Maine and New York. Massachusetts is among the remaining half of states without any form of E-Waste legislation, although legislation has been attempted since 2002. In 2013, six different bills were filed in the session. On March 26th, 2013, the team attended a public hearing and testified in front of the Joint Committee on Environmental, Natural Resources and Agriculture on issues regarding E-Waste.

To prepare for our testimony, we developed a matrix of the three strongest bills, H803, S357 and S386, that had the best chance of being reported out of committee. Furthermore, our team attended the Massachusetts Toxic Waste Seminar hosted by environmental advocates to gain more insight on the E-Waste issue. At the seminar we learned the different viewpoints of legislators, state agencies such as the Massachusetts Department of Environmental Protection, and various environmental advocacy groups. Our research and discussions with relevant stakeholders helped us create a persuasive presentation at the March 21st, 2013 public hearing, by identifying the key attributes needed in progressive E-Waste legislation. Senate bill 357 was most closely aligned with the key attributes we recommended. Consequently, among other attributes, we advocated for, S357, which subsequently was sent out of the Joint Committee on Environmental, Natural Resources and Agriculture and moved on to the Senate Ways & Means Committee.

Our findings demonstrate that there is substantial support for E-Waste legislation. Our evaluation of legislation revealed several key provisions to ensure a successful E-Waste recycling program. Our team identified several provisions that should be considered for any piece of recycling legislation in Massachusetts. First, include provisions for *infrastructure*, or specifically the registration of collectors, processors, and producers within the state in order to track the parties involved and identify violations. Second,

include provisions for *education*, or specifically a variety of ways for the public to learn of the program, especially in the early stages, which requires a combined effort from retailers, processors, producers and government. Third, include provisions for e*nforcement*, or specifically a system to catch fraudulent activity and the legal weight for the Department of Environmental Protection to take action against infractions. Fourth, include a provision for j*oint and several liability*, in other words, responsibility for all participants in the recycling system post-consumer, including collectors, processors, and producers in the event that one member violates regulations or recycles in an unsafe manner. This would also cover products that have multiple producers manufacturing parts. Finally, include a provision for a *solid waste ban on E-Waste*, or a disposal ban that removes E-Waste from the normal waste stream by making it illegal to throw E-Waste in the trash.

Our team has the following recommendation for future endeavors with E-Waste recycling legislation:

1. The team recommends others to use our project as a model to help raise awareness of E-Waste recycling and legislation.

2. The team advises others to use our research as a gateway to understanding the importance and the effectiveness of comparative analysis.

3. Lastly, we recommend that independent researchers conduct future studies on the effectiveness of E-Waste recycling should a bill be passed.

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DEFINITIONS

E-Waste: any electronic product that has reached its end-of-life stage and is no longer in use

Collector: any individual or business that is associated or involved in the gathering E-Waste from the Commonwealth of Massachusetts.

Processor: any individual or business that is associated or involved in the recycling E-Waste from the Commonwealth of Massachusetts.

Producer: any individual or business that is associated or involved in the sale of electronic products to the Commonwealth of Massachusetts.

Basal Convention: an international treaty signed by countries to protect human health and the environment against the adverse effects of hazardous wastes.

Extended Producer Responsibility: a strategy designed to promote the integration of environmental costs associated with goods throughout their life cycles into the market price of the products.

ABBREVIATIONS

CRT – Cathode Ray Tubes

WEEE – Waste of Electrical and Electronic Equipment

EPR – Extended Producer Responsibility

EPA – Environmental Protection Agency

MassDEP – Massachusetts Department of Environmental Protection

ERI – Electronics Recyclers International

BAN – Basel Action Network

LCD - Liquid Crystal Display

QR Code - Quick Response Code

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1 INTRODUCTION

On September 24, 2012, Apple Inc. reported that the iPhone 5 sold five million units in its first weekend (New York Times, 2012). Immediately, millions of older phones became obsolete, eclipsed by the lighter and faster model. Consumers are enamored with technological innovation, which drives them to purchase the newest product on the market. However, these technological innovations come at a cost. According to the Massachusetts Department of Environment Protection, this unwanted technology, more commonly known as electronic waste or E-Waste, is the fastest growing category of waste in the state.

In Massachusetts, consumers must spend time and money to ensure electronic waste is disposed of properly by taking items to special collection sites that may only be open at limited times and may charge a per item recycling fee. As a result, most electronic waste suffers the same fate as any household trash; it is collected and thrown in a landfill, incinerated, or shipped to a third world country. With the correct system and incentives in place, however, consumers can be encouraged to recycle electronic waste safely, keeping the precious – and often dangerous – materials it contains out of the environment.

Policies and programs for handling end-of-life electronic products vary across the globe. In the European Union (EU), electronic waste is known as Waste of Electrical and Electronic Equipment (WEEE). WEEE encompasses ten categories and covers most products that use electricity to function. The EU has adopted the WEEE directive under an international treaty for recycling electronic waste called the Basal Convention. This treaty calls for a producer responsibility model, which makes manufacturers financially responsible for the proper disposal of electronic waste. This model has seen success in Europe and remains the international gold standard as an effective approach to recycling electronic waste (Ogando, 2011).

Electronic waste is commonly referred to as E-Waste in the United States. Unlike WEEE, E-Waste does not include appliances or mechanical devices that use microchips, such as washers, dryers and refrigerators. The United States Environmental Protection Agency (EPA) defines E-Waste as any outdated electronic that may contain harmful chemicals like mercury or lead (EPA, Resources). However, the EPA has no authority to adopt regulations for E-Waste disposal because Congress has not passed any enabling

legislation. As a result, many states have taken an initiative on the E-Waste cause. As of February 2013, twenty-six states have adopted legislation to define, collect, transport, process, and recycle electronic waste. Legislative approaches vary among the states according to social, economic, and political factors. Some states have adopted Producer Responsibility Models and others place recycling costs on the consumers. Currently, Massachusetts has no laws requiring proper disposal of E-Waste.

In an effort to change this, Representative Smizik, Senator Marc Pacheco, and Senator Jamie Eldridge have each sponsored bills that hold producers financially responsible for the safe collection, reuse and recycling of the electronic products they put to market in Massachusetts (Act, 2013). Our team's goal was to facilitate the passage of comprehensive E-Waste recycling legislation in Massachusetts. In chapter 2, we examined the environmental and health repercussions of E-Waste and discuss the ideal E-Waste recycling process of collection, transportation, and processing. Next, we highlighted current international E-Waste policies and guidelines focusing on the European Union, Basal Action Network, and USA Federal Guidelines. Additionally, we provided case studies of California, Washington, Maine, and New York to elucidate the range of policies in practice. Finally, we discuss the current state of E-Waste legislation and policy in Massachusetts.

Our team has developed a two-pronged approach focused on policy and education. For policy, we compared the different pieces of pending legislation in Massachusetts and testified at a public hearing before the Joint Committee on Environment, Agriculture, and Natural Resources. For education, we traveled to a variety of locations, presented on the problem of E-Waste and the current state of Massachusetts legislation, and surveyed Massachusetts residents about their opinions on E-Waste. In chapter 3, we detail our plan and our methods for achieving our objectives.

In total, our team has eight findings from each of the two foci of our methods. Our policy research revealed that Massachusetts legislation should contain provisions for infrastructure, education, enforcement, joint and several liability, and a disposal ban on E-Waste. From our advocacy and education efforts, we found that the public supports producer responsibility and a curbside-pickup collection program.

2 BACKGROUND

2.1 Introduction

Electronic waste represents a growing problem in homes and landfills all over the world. In section 2.2, we explain the diverse range of old electronic items that may be considered electronic waste. In section 2.3, we provide a stepwise narration of an ideal recycling process, with examples from recycling programs that have been proven to be safe and effective. In section 2.4, our team discusses the disposal of electronic waste in the European Union and the efforts of the Basal Action Network, in juxtaposition to current federal policy in the United States. In section 2.5, we explore case studies about electronic waste legislation with overviews of current electronic waste programs from state governments across the United States. These studies define E-Waste, highlight the parties responsible for electronic waste disposal, lay out the goals set forth by law for each program, and assess the program's efficiency since implementation. In section 2.6, we talk about current recycling options for electronic waste in Massachusetts from private and local recyclers. Finally, in section 2.7, our team discusses the legislation moving through the Massachusetts State House and its potential impacts. Our goal is to provide sufficient background on the past attempts for electronic waste legislation, in order to establish an approach that will help aid the passage of an electronic waste bill in the state of Massachusetts.

2.2 What is electronic waste?

Electronic waste, otherwise known as E-Waste, is a category of surplus electronic goods that are no longer wanted or useful, often considered to be 'end-of-life' electronics (Bouvier 2011). E-Waste may be items such as computers, facsimile machines, mobile telephones, electronic games, photocopiers, radios, televisions, video recorders, and DVD players (Robinson 2009). In 2009, the amount of E-Waste in the United States reached 2.37 million short tons, making it one of the fastest growing types of waste (Cobbing 2008). While it constitutes only 1-2% of the total municipal solid waste stream, E-Waste contains heavy metals such as beryllium, cadmium, lead, mercury, and other chemicals such as brominated flame retardants that raise environmental and health concerns (Cobbing 2008). For example, a single television or computer terminal may contain up to 8 pounds of lead in components called Cathode Ray Tubes (CRT's), which are the video display component

of older, bulky-style televisions and monitors (Urbina, 2013). Toxic heavy metals, some of the most dangerous constituents of E-Waste, can lead to human health problems and environmental pollution if not disposed of properly (Cobbing 2008). Only 25% of end-of-life electronics were collected for recycling in the United States, while 75% were disposed of through unknown or illicit means (EPA Waste, 2009).

2.2.1 Societal Effects of E-Waste

There are several ways to dispose of an electronic item when it has reached the end of its life. Ideally, items that are broken might be refurbished. Items that cannot be refurbished and are no longer functional may be recycled, whereby they are broken down into base materials and reconstituted into the manufacturing industry. This is considered 'high-tech recycling' as shown in Figure 1 (Robinson 2009). Additionally, Figure 1 illustrates the 'low tech' and improper recycling methods, whereby E-Waste is incinerated or compacted, taken to a landfill, or exported and inappropriately disposed. The end result is invariably a risk to human health.

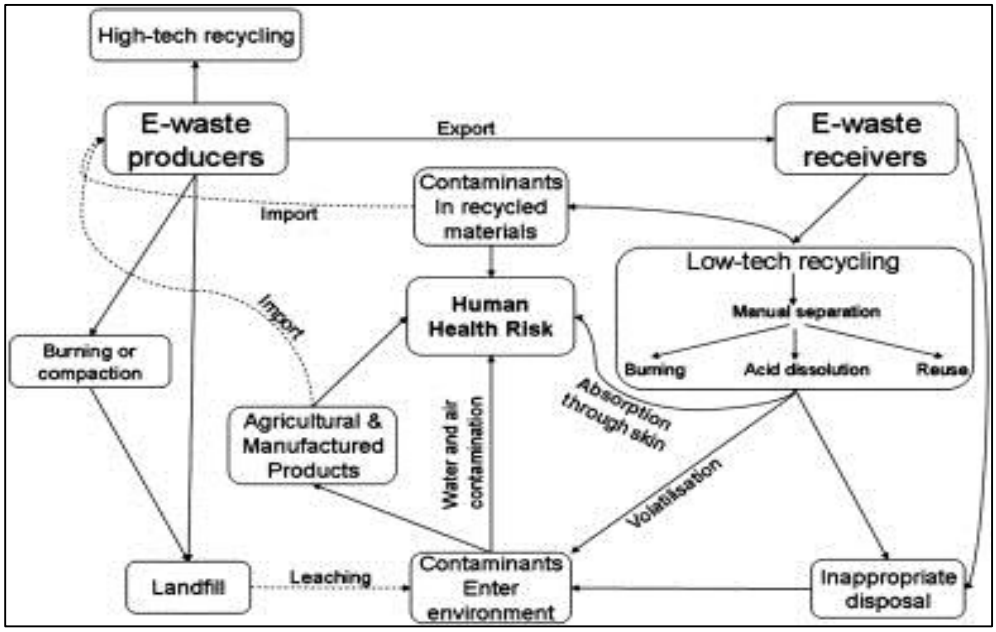

Figure 1: Paths of E-waste contaminants from producers to receivers and ultimately to humans (Robinson 2009)

While many see proper recycling methods as costly and time consuming appropriate recycling and disposal methods will reduce the likelihood of exposure to hazardous materials and protect people from ingesting, inhaling, or coming in contact with

these materials that are known to cause severe health problems including various cancers as well as kidney, liver, and brain damage. Table 1 charts some of the hazardous chemicals contained in E-Waste, what they are used for in electronics, and the health hazards they can lead to when disposed of improperly (Cobbing 2008).

Table 1: Uses and hazards associated with selected chemicals in E-waste (Cobbing 2008).

Chemical	**Use**	**Health Hazard**
Beryllium	Springs, relays, connectors, motherboards	Lung cancer, acute and chronic beryllium disease
Cadmium	Laptops and computer batteries	Kidney and bone damage, heart disease, hypertension, lung cancer
Chromium Hexavalent	Metal housings	Skin reactions, cancer, kidney and liver damage
Lead	Printed circuit boards, cathode rays	Intellectual impairment in children, nervous, blood, and reproductive system damage in adults
Mercury	Lighting devices for flat screens, computer batteries	Central nervous system damage, kidney damage, heart disease
Brominated Flame Retardants	Circuit boards, plastic castings, mobile phones	Brain and skeletal development, permanent memory loss, delayed puberty

In addition to human health hazards, improper E-Waste disposal can lead to environmental contamination. Chemicals can leach and flow into streams and lakes, killing many types of aquatic life. Many chemicals are caustic, alter pH levels, and kill plants compromising the health of the ecosystem they are leaching into (Robinson 2009). When E-Waste is improperly or ineffectively recycled, the natural resources they contain are unavailable for reuse, so new raw materials need to be extracted, mined, or manufactured. These processes cause an increase in greenhouse emissions, water, and air pollution and may release many chemicals and heavy metals into the environment (EPA FAQs).

Mismanagement during disposal and recycling is the main cause of the health impacts and the environmental risks of E-Waste (EPA FAQ). For example, polyvinyl chloride, or PVC, is used in some electronics for insulation on wires and cables. In order to gain access to the valuable copper inside these wires and cables, workers will melt the PVC around the copper and thereby release chlorinated dioxins and furans, which are extremely toxic even in low concentrations. Once these chemicals are released they can travel for hundreds of miles through air, water, and animals and can lead to learning disabilities and cancer in humans if ingested (Cobbing 2008).

2.3 The Safe E-Waste Recycling Process

Less than 20 percent of E-Waste is collected in the United States and most of the E-Waste collected is exported to foreign countries, such as China, India, and Nigeria (Cobbing 2008). Once abroad, the E-Waste is often improperly recycled by untrained workers, who do not have the knowledge or resources to dispose of E-Waste safely (Puckett, 2005). Furthermore, much of the exported E-Waste is stockpiled, with no efforts to remove salvageable parts or find other useful applications for the material (Schmidt 2002).

A good recycling model is one that holds each participant jointly and severally liable. Joint and several liability is a legal term that translates to shared responsibility in negligence and product liability cases, whereby each of the companies involved in the recycling process, seen in Figure 2, can be held individually liable for the entirety of the harm, even if they were only partially responsible.

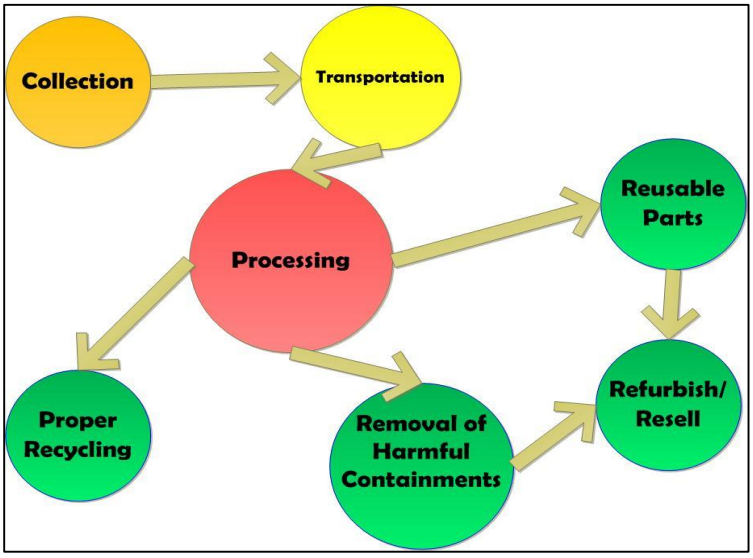

Figure 2: Key steps in recycling E-Waste effectively and appropriately.

One example of a time where joint and several liabilities might have been used comes from a March 18, 2013 New York Times article. The article describes a recycler in California who was illegally storing millions of CRT televisions and monitors in a warehouse, and stacking them in rows 9-feet tall and 14-feet deep. Within a few weeks, the owner abandoned the warehouse, taking the money he had earned for 'recycling' and left the state to pick up the pieces. According to the article, lack of oversight of state programs has led to rampant fraud. If California had legislation that required the collectors,

processors, and producers to be liable for contracting with a fraudulent company, a more effective system would be developed to avoid similar situations.

International and domestic programs exist with well-defined roles that efficiently transfer E-Waste from consumer to safe disposal. The main steps in this model include collection, transportation, processing and proper recycling. In this section, we will detail the roles of each of the participants in the recycling process.

2.3.1 Collection of E-Waste

Collection is the act of gathering, sorting, and packaging E-Waste for transportation and proper disposal. Collection is the gateway for consumers to recycle electronic waste. This step ensures proper E-Waste recycling because if electronic waste is not separated from the common waste stream, then there is little chance to recover E-Waste's materials through recycling. There are six types of collection most commonly used in the United States and internationally, including (1) curbside pick-up by collection companies with trucks, (2) donation to charitable organization such as the Salvation Army, (3) collection events hosted by recyclers, governments or private companies, (4) drop off locations at companies such as Best Buy or local municipal recycling facilities, (5) mail-in services through companies such as Apple Inc., or (6) simple disposal in the common waste stream by throwing E-Waste in the garbage.

Most states and cities provide drop-off locations and other still provide curbside pickup on periodic dates with the appropriate funding, but there are usually associated costs with recycling that tend to dissuade the consumer. Cost and convenience are basic factors in any person's willingness to participate in a program. In states that do not have a well-advertised, convenient E-Waste recycling program, consumers with the mind to recycle must spend time and money to locate, pay for, and travel to electronic waste collectors before passing their E-Waste off to recycle. However, there are companies that reduce the time and distance required to recycle, such as the electronic waste company Electronic Recyclers International (ERI). ERI is an E-Waste recycling company that assists its' customers – most often small to medium sized businesses and municipal collection sites – by offering various options to recycle, including curbside collection, weekend collection events or special collection events that coincide with existing community events (ERI-Customer Service). Moreover, ERI assists with E-Waste recycling public relation

campaigns, such as radio advertising, newspaper ads, and mass communication. Such events provide opportunities to educate and attract community members to help solve the E-Waste problem (ERI-Customer Service). Still, incentivized and organized collection is only the starting point for the proper E-Waste recycling process.

2.3.2 Transportation of E-Waste

As shown in Figure 2, transportation is the next step in the E-Waste recycling process and consists of moving E-Waste from collectors to processors or processors to recyclers. Collectors often have prearranged agreements with a processor or E-Waste recycling company to ensure safe transport. For instance, ERI can be both the collector and processer because they have own their own trucks that transport E-Waste from collection sites to the major processing facilities. ERI uses a bar code system that helps to track any E-Waste that is in their possession. This bar code system ensures that all collected E-Waste is tracked throughout processing and indicates ERI's claim of possession and ownership to avoid exportation to foreign nations (ERI, Downstream Transparency). Transportation can be costly since recycling centers are relatively few in number and may draw waste from large service areas. For example, ERI has only seven recycling centers nationwide, including one in Holliston, Massachusetts (ERI-Homepage). Though sometimes not addressed in states' E-Waste recycling policies, transportation plays a significant role in the proper E-Waste recycling process.

2.3.3 Processing of E-Waste

Processing is the disassembly of E-Waste into its system components. Sometimes, a processor merely takes these electronic components and either resells them as refurbished parts to consumers or ships them overseas to be reused. Ideally, the processor is responsible for separation of E-Waste into reusable parts and basic raw materials, the 'high-tech' solution. During this step, E-Waste takes many forms as it is broken down into its constituent materials.

Consider a computer monitor that has just arrived in the ERI's processing facility from a collection site. ERI personnel examine the monitor for damage and overall quality. After examination, personnel separate any reusable parts, like screws, from the monitor. These screws are examples of reusable parts that are often resold back to manufactures. Then, ERI personnel will remove any hazardous E-Waste components such as CRT's or

Liquid Crystal Displays (LCD's) that often contain small amount of mercury. It is imperative that hazardous components in televisions and computer monitors are removed before shredding the E-Waste to recover raw materials such as steel and glass. Currently, many states ban CRTs from combustion and disposal in landfills and violation of these laws can sometimes cost the processors up to $25,000 in fines (Kirkke, 2008). According to the New York Times article from March 18, 2013, 660 million pounds of CRT glass is stockpiled in warehouses across the country waiting to be recycled. This will cost an estimated $85 million to $360 million to recycle responsibly, as the demand for recycled CRT glass has fallen after the 2009 federally-mandated transition from analog to digital televisions caused an increase in waste generation (Urbina, 2013).

After stripped of dangerous parts, the computer monitor goes through a huge shredder. The goal of the shredder is to reduce the size of E-Waste into "uniform rough pieces" (Kirkke, 2008). Breaking down and sorting allows E-Waste recyclers to extract as many raw commodities as possible. These harvested materials, especially steel, glass, copper and aluminum, are resold to manufacturers to generate income for E-Waste recyclers (Kirkke, 2008). ERI reduces the E-Waste it accepts into three main raw commodities: metals, plastic and glass (ERI-Commodity Aggression). Thus, processing is often a complicated step and all the components of E-Waste must be appropriately handled to protect human health and the environment.

2.4 Current E-Waste Policy/Guidelines

A diverse array of electronic waste policies exists in the world today. Some are treaties ratified by governments and endorsed by corporations, others are programs backed by legislation and enforcement, and still others are merely suggested guidelines that hold no one liable for noncompliance. Most often, these policies are distinguished by their definitions of E-Waste, recycling technologies, and the liability for the costs of recycling. In this section, we will review several policies established at the international and federal levels.

2.4.1 Basel Action Network

Originated in 1989, and entered into force in 1992, *The Basel Convention on the Control of Transboudary Movements of Hazardous Wastes and Their Disposal* is a global treaty that is intended to slow the exportation of hazardous waste to foreign countries.

(Puckett, 2005). The Basel Action Network (BAN) is an international charitable organization that was created to fight international environmental injustice and toxic trade (Puckett 2005). BAN is the "non-governmental watchdog" for *The Basel Convention*, with a mission statement as follows:

"BAN works to prevent the globalization of the toxic chemical crisis. . . [W]e work to ensure national self-sufficiency in waste management through clean production and toxics use reductions and in support of the principle of global environmental justice…" ("Basel Action Network (BAN): About", 2011)

BAN focuses on finding information on toxic trade, advocating for international policy, and conducting research and investigations to document the existence of toxic trade. Two examples of places that have adopted the Basel Convention with success are Japan and the countries of the European Union, which have implemented strong customs security measures. Unfortunately, the lack of oversight at customs checkpoints, the costs of safe disposal, and the failure to promulgate appropriate regulation for recycling programs encourages companies to export E-Waste to developing countries. BAN struggles to take action against poor E-Waste management because economic pressures encourage inappropriate disposal and exportation of e-waste. The United States is the world's foremost leader in this market (Puckett, 2005). As a result of negative economic pressure, BAN started the *e-Steward* project, which is an accreditation program for electronic waste recycling companies to show they comply with a high standard of recycling practices and do not export their waste to foreign countries (Puckett, 2005).

2.4.2 Difference between WEEE and E-Waste

There are many definitions of electronic waste, with two of the most frequently used being E-Waste and Waste Electronic and Electrical Equipment, also known as WEEE (Ongondo, 2011). E-Waste is defined by the EPA as any outdated electronic that may contain harmful chemicals like mercury or lead (EPA, Resources). WEEE is a term used in the European Union, to describe a spectrum of devices, including typical electronic equipment such as computers, televisions, and televisions, as well as appliances and other tools and mechanical devices that increasingly incorporate microchips.

In February, 2002, the 27 member countries of the European Union ratified a directive on WEEE (Ongondo, 2011). The directive focuses on reducing electronic waste

and increasing environmentally sound recycling, in order to reduce hazardous waste disposal in landfills. A recent update to the WEEE directive is designed to achieve the collection of 85% WEEE by 2016 (Let's-Recycle, 2008) by involving all the stakeholders of WEEE, namely the producers, processers, producers and consumers. Electronic waste is considered WEEE and is separated under the WEEE directive into the following ten categories:

Table 2: WEEE Categories and Examples

Categories	**Examples**
1. Large household items	Refrigerators, freezers, washers, dryers, stoves
2. Small household appliances	Vacuums, toasters, iron, clocks, scales
3. Information technology and telecommunication equipment	Printers, computers, printers, telephones, calculators, cell phones
4. Consumer equipment	Televisions, video cameras, audio amplifiers
5. Lighting equipment	Fluorescent lamps, discharge lamps, sodium lamp
6. Electrical and electronic tools	Drills, saw, tools for welding
7. Toys/leisure/sports equipment	Video games, coin slot machines, electric trains
8. Medical device	Dialysis, radiotherapy equipment
9. Control instruments	Smoke detector, thermostats, control panels
10. Automatic dispensers	Soda and vending machines, ATMs

The directive requires disposal methods that account for the separation of specific components, such as gas discharge lamps containing mercury that need special handling requirements. There is a cost to processors associated with breaking down the components of E-Waste into recyclable materials. Legislators chose to pay for this cost with an environmental policy known as *Extended Producer Responsibility* (EPR). The EPR model holds producers, those that create electronic products for the market, take responsibility for removing those products from the market. To do so, producers are held financially responsible for the costs of collection, transportation, and processing (Bohr, 2007).

With the EPR model, producers build products that are easier to recycle and contain less hazardous chemicals. In fact, a producer cannot sell a product in the European Union market without WEEE registration (Lauridsen, 2010). These WEEE standards blanket many different types of electronics while in the United States, E-Waste regulations only include electronic products that contain dangerous components, such as CRTs.

2.4.3 USA Federal Guidelines

In contrast with Europe, the United States does not have any federal policies for regulating E-Waste. Federal legislation has been introduced in the United States Congress, but none has been implemented, and there is no national program for recycling E-Waste. The United States is also one of three countries worldwide, along with Afghanistan and Haiti, who have signed the Basel Convention, but have failed to ratify it (Kiddee, 2013). The EPA, a U.S. federal agency that focuses on protecting human health and the environment, would be tasked with implementing and maintaining a federal E-Waste program. However, the EPA guidelines pertaining to E-Waste currently pose no consequences to parties who fail to comply. The only enforceable EPA regulation of e-waste covers of cathode ray tubes (CRTs) (EPA Standards, 2012).

In November 2010, the President created an interagency task force on electronics stewardship to develop nationwide guidelines on E-Waste. The taskforce developed a national plan for electronic stewardship. The EPA, the General Services Administration (GSA), and the Council of Environmental Quality (CEQ) led the taskforce. The taskforce identified four overarching goals for a robust E-Waste recycling program in the United States (EPA, Taskforce). The first goal seeks to provide incentives to companies for creating 'greener' electronics, products which are easier to recycle and use less hazardous chemicals. The second goal ensures the federal government leads by example with actions such as take-back programs and using certified E-Waste recyclers. The third goal aims to increase safe and effective handling of used electronics in the United States by partnering with the recycling industry and providing standards for employees of collectors, processors, recyclers, etc. The last goal suggests better management and safe handling when exporting E-Waste to developing countries (EPA, Taskforce). For example, a potential partnership with a developing country would create infrastructure in the country and allow the safe exportation and recycling of E-Waste. From these goals stemmed the United States' own version of the e-Steward standard; Responsible Recyclers, or R2s are recognized safe recyclers. However, the EPA has no means of enforcement; as an extension of the executive branch of government, the EPA cannot pass laws, but only abide by and enforce them. The EPA has not been charged under any federal law to manage E-Waste. Consequently, the agency has no authority to penalize those who do not properly follow

their suggestive E-Waste guidelines or R2 certification. The U.S. Congress could pass a law or the President could pass an executive order, which empowers the EPA to enforce E-Waste policy, or federal courts could reinterpret hazardous waste management laws to incorporate E-Waste.

2.5 State Programs

Unlike the 27 countries of the European Union, which have ratified the WEEE directive and the Basel Convention, the 50 United States do not have a shared goal for managing the growing problem of E-Waste. The EPA's guidelines on E-Waste do little more than act as suggestions (EPA Standards, 2012). However, 26 states, as well as New York City, have adopted their own legislation, with varying degrees of success (NCER, 2012). The range of legislation passed in states is perhaps as diverse as the states themselves. In Europe, producers must cover the entire cost of recycling a broad range of electronic devices through a model based on *extended producer responsibility*. In contrast to the European model, California passes all of the cost of E-Waste recycling onto the consumer at the time of sale for certain electronic products, in a model that uses an advance recovery fee (Perry, 2006). Most state programs fall in between these extremes. For example, in Maine, producers pay for recycling and some collection and local government covers the remaining associated costs, called *modified producer responsibility* (Wagner, 2009). Still others, like the state of New Hampshire, dwell on the fringe of recycling, where they ban products from landfills but do not stipulate what to do with them (Perry, 2006). We critically examined and categorized state programs for recycling E-Waste, considering both their approach and the success they have had in reducing E-Waste.

2.5.1 Limited Recycling Solutions

In 2003, California was the first state to pass domestic E-Waste legislation (Electronic, 2003). The Californian plan limits the definition of a "Covered Electronic Product" to items with screens of at least four inches diagonally, with no mention of the central processing units (CPUs), those parts that often contain hazardous or rare chemicals (Electronic, 2003). Additionally, the state uses the advanced recovery fee model, where consumers pay a fee at the time of sale. This money is used to fund recycling programs across the state and never returns to the consumer upon recycling (Buseman, 2012). This fee-upon-sale approach has been shown to be less effective in encouraging consumers to

recycle than producer responsibility models, which tend to bury recycling costs in the price of the product (Buseman, 2012). Fee-upon-sale models increase the availability of recycling and create infrastructure for proper disposal, but leave little incentive to the consumer to follow through.

2.5.2 Modified Producer Responsibility

In 2004, the state of Maine was the first state to pass legislation of the producer responsibility model (Sale, 2012). However, the Maine model is not the same as the EU model that holds manufacturers to complete financial liability. Instead, Maine uses a model that is now known as modified producer responsibility (Wagner, 2009). The legislators defined a covered electronic product as a product containing a Computer Processing PU, CFR, or flat-panel display greater than four inches diagonally. Furthermore, the law only places responsibility on manufacturers that produce computer monitors and televisions (Sale, 2012). The gap in responsibility in the statute can allow those electronic peripherals other than monitors to fall through the system. Maine's modified producer responsibility model has three primary stakeholders that share some of the financial burden – the producer, the consumer, and the local municipality in which the E-Waste is disposed (Wagner, 2009). Maine's program requires the consumer to pay for the transportation of E-Waste to a designated municipal collection sight, the municipality to pay for the storage and preparation of E-Waste for shipment, and the manufacturer to pay for the transportation and recycling of E-Waste after collection (Wagner, 2009).

This program shows definitive success; in the first three years of 2006, 2007, and 2008, Maine reported that 308,277 items were collected from a population of 1.32 million people. That is 1.64 kilograms per capita annually (Wagner, 2009). When compared to 2005, the year before the program was implemented, there was an average annual increase of 165% for collected and recycled E-Waste items (Wagner, 2009). See Figure 3 below, for an illustration of the trend of covered electronic products collected in Maine. This shows that Maine implemented a model that has successfully increased recycling of televisions and computer monitors, although few other forms of E-Waste are accounted for in the modified producer responsibility law.

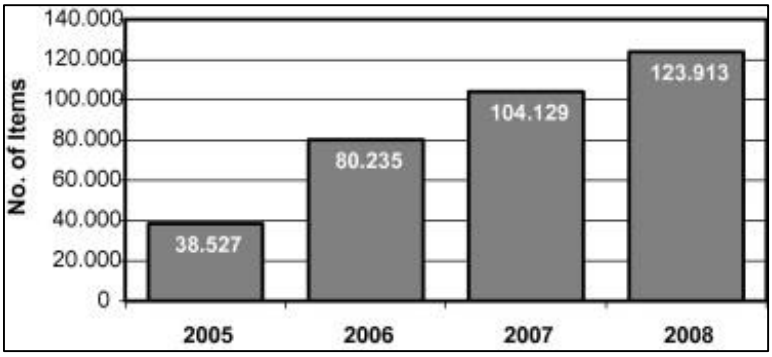

Figure 3: Number of household covered electronic devices collected in Maine, 2005-2008 (Wagner, 2009).

The state of Washington adopted legislation for a program called E-Cycle Washington in 2006 (Washington, 2006). Washington used an EPR model that is related to the WEEE directive, but is not as extensive in coverage (Templeton, 2011). The program came into effect on January 1, 2009 and defined E-Waste as end-of-life products with screens larger than four inches (Washington, 2006). Washington's E-Cycle program mandates that manufacturers implement and finance their own plan for collection, transportation, processing and recycling (CTPR) from "covered entities" – any household, charity, school district, small business, or municipality (Washington, 2006). Further, the processors must submit to audits by the state's Department of Ecology (DOE), with certain minimum standards and preferred performance standards. The minimum standards aim to maximize recycling, while the preferred standards aim to generate value and recover materials (Templeton, 2012). The minimum standards make no call for a proper recycling process, which leaves a loophole for producers to exploit. (Templeton, 2012). Washington implemented an efficient program that has been largely successful, as illustrated by Figure 4, below.

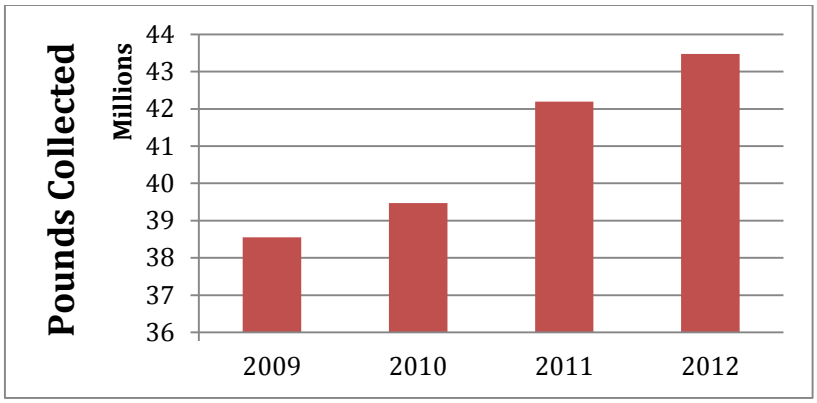

Figure 4: Pounds of E-Waste collected in Washington State, 2009-2012 (DOE, 2012).

2.5.3 E-Waste Recycling Leaders

Currently, New York State has the most comprehensive approach to E-Waste disposal, with the adoption of the Electronic Equipment and Recycling Act (Buseman, 2012). The act establishes a program that is a feasible, efficient model of extended producer responsibility. However, it was not New York's first foray into E-Waste legislation, but rather the outcome of a long battle waged between manufacturers and politicians. The first law passed with regard to E-Waste in New York was actually a New York City law. New York City's law mandated complete producer responsibility for all costs of a CTPR program, with a provision in the law that allowed the recycling program to extend "to the maximum amount as approved by the New York City Council" (Local, 2008). This left considerable power in the hands of the City Council. Shortly thereafter, the Consumer Electronics Association filed a lawsuit alleging that the law imposed too many requirements on manufacturers, including the mandate that manufacturers provide free, door-to-door pickup service (Ruseman, 2012). Before the case could be resolved, the New York State legislature passed a bill that superseded the City Law and included a more moderate producer responsibility program (Electronic Equipment, 2010).

The Electronic Equipment and Recycling Act (EERA) of New York State was passed on May 28, 2009 (Electronic Equipment, 2010). The EERA broadly defines covered electronic equipment as computers – an electronic, magnetic, optical, or electrochemical processing device, including CPUs and all monitors – along with peripherals, CRTs or televisions. Additionally, the New York State law provides specific requirements for many parties involved in a proper recycling process. For example, as of April 2011, manufacturers must provide complementary recycling of E-Waste to consumers at the time

of purchase (Electronic Equipment, 2010). This creates a built-in stream of recycling for products that might otherwise be discarded. Additionally, this closes a loophole whereby orphaned waste, the end-of-life products that cannot be attributed to an existing producer because of bankruptcy or other factors, may fall into the normal waste stream. The manufacturers are encouraged to work together through efforts called 'collectives' to recycle.

These collectives are collaborative relationships whereby multiple manufacturers can come together to meet the state's mandated E-Waste goals, thus completing their own requirements. The New York State law also requires manufacturers to collectively recycle three pounds per capita annually by April 2011 (Electronic Equipment, 2010). This goal increased to five pounds per capita in 2012 and 2013, with reevaluation scheduled for 2014. If a manufacturer recycles more than its market share in a year, it may collect credits towards future years to avoid fines by the New York Department of Environmental Conservation (Electronic Equipment, 2010).

New York State had a unique experience when it passed legislation on recycling E-Waste; the state essentially was able to leverage the weight of one of the largest cities in the world in order to spark movement in the electronics industry. As a result, the state was able to institute broad definitions of E-Waste in their producer responsibility model, with clear requirements for recycling rates and a plan for the future. The New York State law stands as a model for the rest of the United States on proper E-Waste regulation.

2.6 E-Waste in Massachusetts

Unwanted consumer electronics are the fastest-growing category of waste in The Commonwealth of Massachusetts. The Massachusetts Department of Environmental Protection (MassDEP) states that an annual average of 900,000 E-Waste products were thrown away before 2009 (MassDEP, Electronics Recycling). The federally mandated transition from analog to digital television broadcasting came into effect in 2009 and led to the increased disposal of outdated CRT televisions in particular. Furthermore, Massachusetts has banned certain items from solid waste disposal facilities, landfills, combustors, and debris handling sites, with the intent of "reduc[ing] the impact of solid waste management on the environment and conserve[ing] capacity at existing solid waste disposal facilities" (MassDEP, WasteBans, 2013). However, Massachusetts law includes

few electronic materials as banned solid waste, so the MassDEP lacks the authority to regulate most forms of E-Waste. The types of waste that are banned from the normal solid waste stream in Massachusetts can be seen in Table 3. Mercury, CRTs, and aluminum items are most similar to E-Waste, although many forms of E-Waste do not contain these chemicals. Any E-Waste that does not contain the listed materials may be disposed of through a landfill or combustion.

Table 3: Banned Solid Wastes in Massachusetts (MassDEP, WasteBans).

Type of Waste	**Examples**
Cathode Ray Tubes	bulky-style televisions, computer monitors, oscilloscopes
Clean Gypsum Wallboard	un-painted drywall
Glass Containers	glass bottles, Pyrex cookware, windows
Lead Batteries	Lead-acid batteries used in motor-vehicles
Leaves	deciduous and coniferous leaves
Metal	building materials, industrial equipment, vehicles
Metal Containers	aluminum, steel or bi-metal beverage and food containers
Recyclable Paper	all paper and corrugated cardboard
Single Polymer Plastics	all narrow-neck plastic containers, labeled 1-6
Tires	continuous or pneumatic rubber from motor vehicles
White Goods	refrigerators, dishwashers, dryers, ovens, and water heater
Wood/Yard Waste	treated and untreated wood, seasonal depositions
Mercury	LCD displays, glass thermometers

Although the MassDEP cannot enact policy and cannot currently enforce alternative means of disposal for E-Waste, they do provide a list of alternative means of collection, consistent with the private-party options of collection discussed in section 2.3.1. Namely, donation, re-use, drop-off, and mail-in options are listed on the MassDEP website (MassDEP, Electronics Recycling). The MassDEP recommends donation and re-use companies such as Goodwill or Charity America as a first choice to consumers looking to discard electronic products. Donation and re-use options offer a solution that extends the life of the electronic product by prolonging its functionality, but they do not necessarily change the fate of the product. Drop-off and mail-in options through companies such as Best Buy, Sony, and Apple are another option in Massachusetts. In particular, Best Buy only uses certified e-Stewards or R2 recyclers. However, under current Massachusetts law, these retailers are not currently required to recycle any E-Waste they collect in a safe

manner. For a more detailed examination of the roles of collectors, who often are retailer as well, refer to section 4.1.1

Some towns in Massachusetts offer collection through municipal recycling centers, which contract collectors and processors to dispose of E-Waste. The recycling center typically charges consumers a fee upon disposal to offset the cost. If there is no fee, the cost must be transferred to residents through municipal taxes and fees. As there are no state laws on proper disposal, the contracted collection and processing companies are not regulated by the MassDEP to recycle responsibly. In section 4.2.3, our team discusses the preferred method of collection in over 400 surveyed Massachusetts residents.

2.7 Massachusetts Legislation in Progress

Although there is no current legislation in Massachusetts to mandate E-Waste recycling, several state legislators have sponsored related bills. Representative Strauss sponsored a bill to reinstate the Clean Environment Fund, which could provide funding to an E-Waste recycling program. Representative Smizik, Senator Eldridge, and Senator Pacheco each have sponsored bills H803, S357 and S386, respectively, which each aim to institute EPR-based E-Waste recycling in Massachusetts. House bill 803 and Senate bill 357 are essentially the same bills, with the exception of one provision that S357 contains for the establishment of an Advisory Committee. S357 and S386 are almost completely different, with differing definitions, stakeholders, and goals. Section 4.1 contains a complete analysis of the key differences between H803, S357 and S386.

Representing the 10th Bristol District in Massachusetts, Representative William Straus is a member of the Massachusetts Hazardous Waste Facilities Site Safety Council. Previously and worked directly with the EPA to prevent the government from incinerating waste and sending dangerous emissions into the environment (Representative Bill Straus 2013). He is currently on the House Ways and Means Committee and sponsored a bill to reinstate the Clean Environment Fund, which would increase recycling rates in Massachusetts municipalities. This fund could theoretically supplement the cost of auditing E-Waste recyclers in Massachusetts by removing some of the financial burden on the MassDEP, if legislation passes making the MassDEP E-Waste recycling budget dependent on the revenue generated from fees and fines.

First, from the 15th Norfolk District, Representative Frank Smizik has sponsored House bill 803. Representative Smizik is Chair of the House Committee on Global Warming and Climate Change. His bill H803, *An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products*, is essentially the same piece of legislation as S357, proposed by Senator Jamie Eldridge.

Next, Massachusetts State Senator Marc Pacheco has sponsored bill S386. Senator Pacheco has represented the 1st Plymouth and Bristol district since 1993. He currently chairs the Senate Committee on Global Warming and Climate Change and the Joint Committee on Environmental, Natural Resources and Agriculture. Senator Pacheco's bill, *An Act relative to information technology producer responsibility,* aims to mandate an EPR-based approach to recycling E-Waste in Massachusetts. However, S386 has several definitions that could be more expansive and several provisions that could be more strongly worded in order to increase the coverage of a Massachusetts E-Waste recycling program.

Finally, Massachusetts State Senator Jamie Eldridge has sponsored bill S357. Senator Eldridge is Vice-Chair of the Senate Committee on Global Warming and Climate Change and currently works to preserve funding for the Toxic Use Reduction Institute. He has sponsored bill S357, *An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products*. This legislation would create a strong E-Waste recycling program that could serve as a model for the rest of the nation. The E-Waste bill sponsored by Senator Eldridge has seen four major revisions since it was first introduced in 2010 (Act, 2013). Senate Bill 357 mandates an EPR model that regulates and audits each of the members in the safe recycling process detailed as seen in section 2.3, in addition to producers; however, it does not contain a provision for joint and several liability, which would ensure that every member in the process is responsible for contracting with companies that recycle safely. Refer to Section 4.1.1 for a discussion on the infrastructure and relative requirements for companies involved in the E-Waste recycling process.

When considering the three E-Waste recycling bills currently moving through the State Legislature, S357 is the strongest and promises to be the most impactful.. With sufficient support from environmental groups, citizens and politicians, it may yet be passed as a cohesive augmentation to current Massachusetts solid waste regulations. The primary

goal of our project is to aid in the passing of this bill by identifying the range of opinions of these stakeholders and advocating for their support.

2.8 Policy Overview

In conclusion, E-Waste policy has been around in some shape or form since the establishment of the Basal Convention in 1992. The European Union created the WEEE directive, an EPR-based model to recycle E-Waste, which has seen the highest recorded recycling rates in the world. The United States Congress has failed to pass legislation in any form on E-Waste recycling, so the burden has fallen to the States. Twenty-six states have passed laws on E-Waste, with the majority choosing to adopt the Extended Producer Responsibility model and make the companies that manufacture electronic products finically responsible for safely recycling the products they put to market. In Massachusetts, there is no current law or policy on recycling E-Waste, although there are three bills currently in the Massachusetts State Legislature. Of the three, S357 provides the best chance for Massachusetts to become a leader in E-Waste recycling.

3 METHODOLOGY

3.1 Introduction

The purpose of this project was to facilitate the passage of progressive E-Waste legislation in Massachusetts. In order to do so, the team has broken this task into two main areas of focus: Policy and Education. See Figure 5 for an outline of our methodological approach.

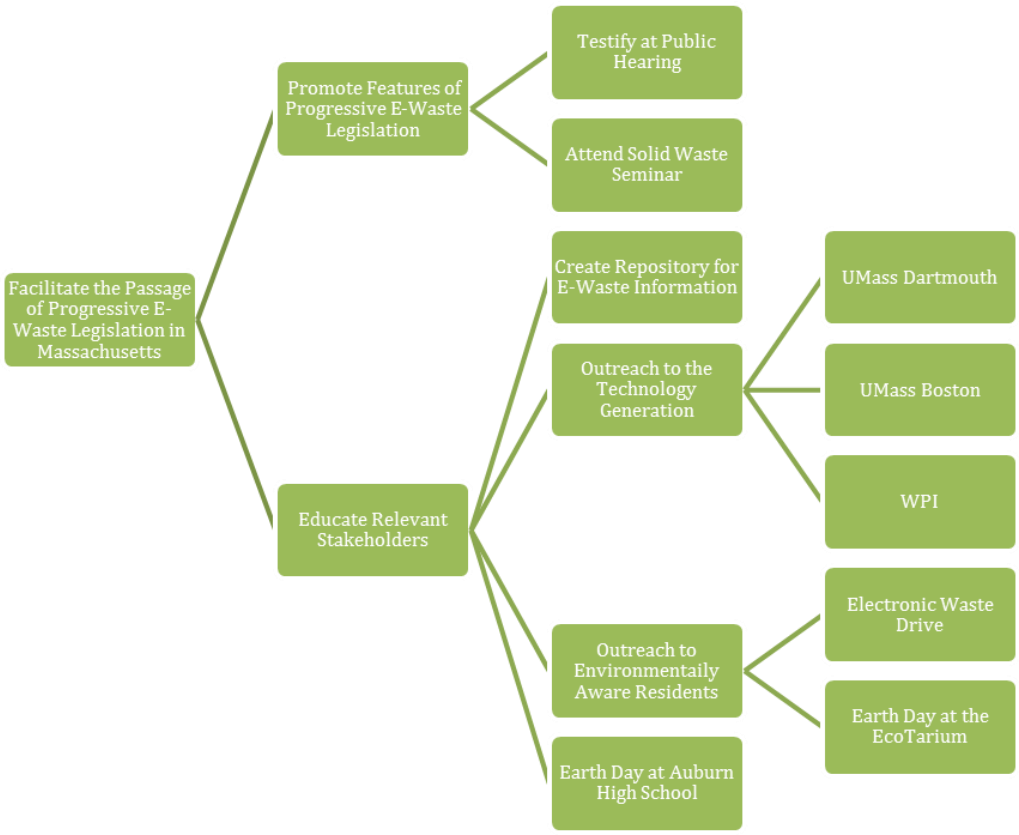

Figure 5: Goals and Objectives Tree

Our team first focused on promoting the most progressive and appropriate legislation in Massachusetts, found in section 3.2. To achieve this objective, the team identified features to be included in strong legislation based on research from other states, environmental organizations, and currently filed bills. Once this was completed, the team testified at a public hearing and attended a Solid Waste Seminar. The team then switched focus to educating Massachusetts residents about E-Waste recycling and E-Waste Legislation. The first task was to create a website that summarizes the issues of E-Waste in Massachusetts, hosts a survey to give opinion on legislation, shows locations of recycling locations, provides helpful links to other websites that detail specific E-Waste

related issues, and offers a pre-formed petition with a map of districts and contact information for Massachusetts Legislators so viewers can demonstrate their support for the bill. Next, the team educated college students across Massachusetts, thereby tapping the power of a demographic that we can relate to well and represents the technological generation. In section 3.4, we describe the task of outreaching to groups that already show interest in environmental issues such as attendees of the E-Waste recycling drive and EcoTarium's Earth Day Celebration. Finally the team educated high school students at Auburn High School to promote the idea of E-Waste recycling at a young age. Together, these techniques form a well-rounded plan for advocating for passage of strong, effective E-Waste legislation. See Figure 5 for an outline of our methodological approach.

3.2 Policy

Our team took an active role on the legislative side of E-Waste with the Massachusetts state government. We wanted to advocate for the strongest possible E-Waste legislation to be passed. We needed to fully comprehend and dissect different types of legislations and present our findings to the appropriate legislators in a concise and organized manner. To accomplish this, our team went to a public hearing at the Massachusetts State House and attended at Solid Waste Seminar.

3.2.1 Public Hearing

Our opportunity to express our position on E-Waste legislation took place at a public hearing for E-Waste Issues in front of the Committee on Environmental, Natural Resources, and Agriculture. According to The Massachusetts Executive Office for Administration and Finance, a public hearing is a "forum for discussion and testimony by the public to the Committee which is considering a bill. No transcripts of hearings are kept." (www.Mass.gov). Table 4 contains the names, numbers and sponsors of the six bills discussed before the committee on the day of our hearing.

Table 4: The six bills presented at the Public Hearing on E-Waste at the State Capitol.

E-Waste Issues
March 26, 2013, 10:00 AM, Hearing Room B1
COMMITTEE ON ENVIRONMENT, NATURAL RESOURCES, & AGRICULTURE

March 21, 2013 E-Waste Bills

Bill Number	Sponsor/Title	
H729	Rep. Jones	An Act establishing the commission on extended producer responsibility
H741	Rep. Kocot	An Act to create a framework to re-allocate responsibility for discarded products
H803	Rep. Smizik	An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products
S346	Sen. Chandler	An Act to create a framework to re-allocate responsibility for discarded products
S357	Sen. Eldridge	An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products.
S386	Sen. Pacheco	An Act relative to information technology producer responsibility

Our team's first task to prepare for the hearing was to dissect all the bills and complete a comparison chart of the strengths, weaknesses, and difference between these bills. After compiling this information we reached out to our contacts at Clean Water Action, our sponsor Kelsey Smithwood, and our advisors to review the points and information presented in the bills and allow them to make recommendations. Finally, we reviewed our background research for recommendations from other states' legislation to compile our final list of recommendations to present to the committee. We broke up our testimony into three parts for each of our team members to present and drafted a letter to all legislators on the committee. The letter needed to be formal and under a page to highlight the points of our testimony and give references to our research.

3.2.2 Solid Waste Seminar

Our group had another opportunity to communicate with legislators and specialists in the field about E-Waste and the dangers of landfills. Attending this seminar allowed us to gather more knowledge about the broad spectrum of solid wastes and how E-Waste fits into it. We also had an opportunity to see what other types of waste legislation have been drafted. Finally, at this time we were able to take notes and ask questions to all the speakers and legislators.

3.3 Education

While creating a progressive bill and outreaching to legislators is extremely important, legislation holds no power unless the public is educated on the issue, there is sufficient on the ground support and appropriate enforcement. Consequently, we worked

to create an outreach medium for Massachusetts residents to gain support for legislation and inform them about E-Waste recycling. To accomplish this, the team first created a website to serve as a repository for all E-Waste related information in Massachusetts. The team also traveled to colleges that had student bodies composed of greater than 95% Massachusetts residents. Finally the team focused on outreaching to residents who are already environmentally aware at WPI recycling events and Earth Day celebrations.

3.3.1 Creating a Repository of E-Waste Information

In an effort to educate Massachusetts residents and E-waste stakeholders, we developed a website as a repository of E-Waste information for the Commonwealth of Massachusetts, hosted at https://sites.google.com/site/massewaste/. Our goal was to design a website that becomes the portal for the residents of Massachusetts to learn about, and participate in proper E-Waste recycling and support E-Waste legislation. We included background information on E-Waste recycling, E-Waste recyclers and certifications. In addition, the site has a survey for visitors to complete, and links to government and environmental groups associated with E-Waste recycling efforts. Our website pages can be found in Appendix B. The website keeps supporters of E-Waste legislation in touch with the most accurate and updated information and gives them a chance to advocate for E-Waste legislation. The follow sections identify the key attributes of our website.

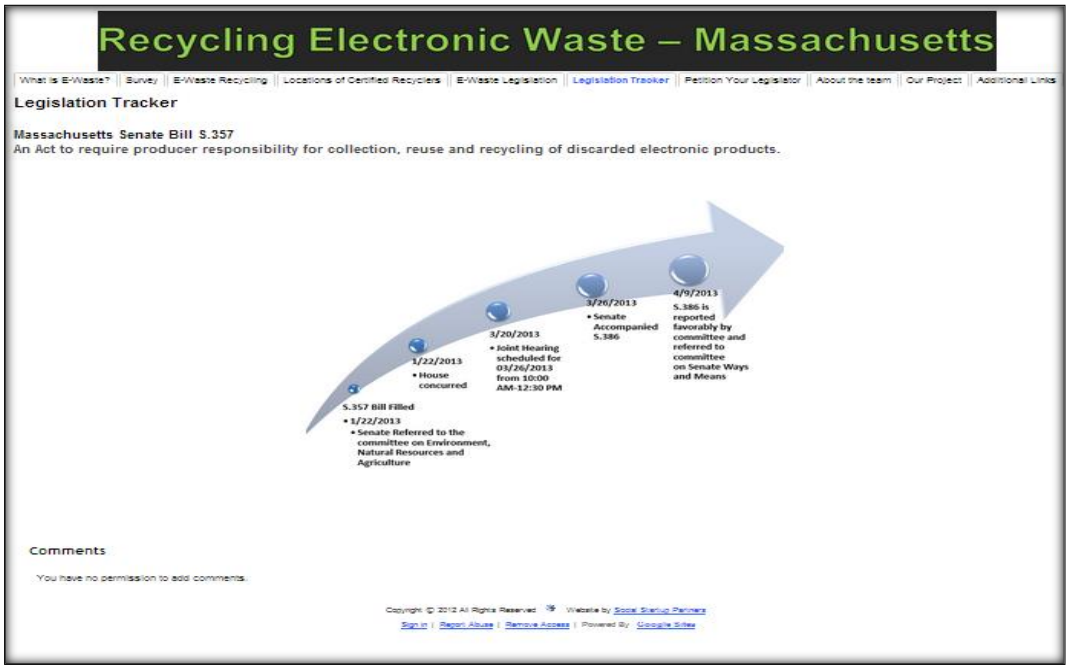

Figure 6: Timeline/Progress Tracker for the E-Waste Bill

On the website, our team has a page devoted to educating viewers on the progress of E-Waste legislation within Massachusetts. The timeline acts as a progress tracker, as seen in Figure 6, for the current bill and was updated based on available information. The progress tracker allows constituents to be well informed about any updates on the E-Waste legislation in the Massachusetts.

Surveying provided the team a two-fold benefit; (1) we can research E-Waste awareness among a rising Massachusetts demographic; the technology generation and (2) we can educate and garner support for E-Waste legislation in Massachusetts.

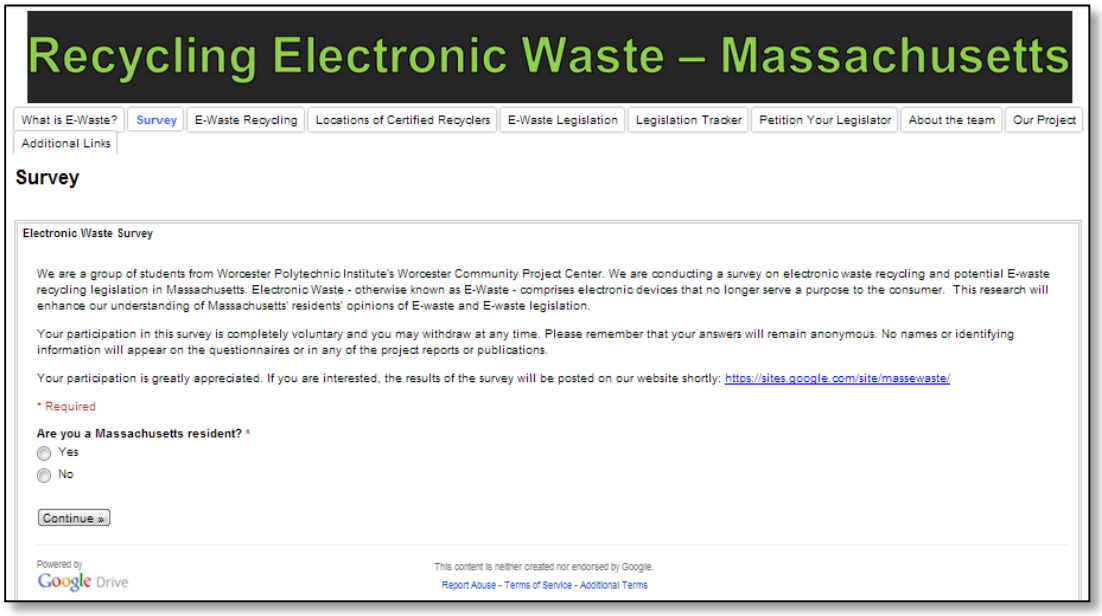

Figure 7: Survey for Massachusetts Residents on E-Waste

The survey was created online through Google Forms. Google Sites allowed our survey (a Google Form) to be embedded into our website for all visitors to fill out as seen in Figure 7. The best advantage is Google Forms automatically generated a spreadsheet that with the timestamp and responses to all survey questions. We created an initial screening question, asking whether the person is a resident of Massachusetts in order research our target audience. The entire survey can be found in Appendix A.

To provide convenience to our target audience, as well as to take advantage of a popular trend, we made our website accessible through a Quick Response (QR) Code for smartphone apps, seen in Figure 8. We passed out little quarter sheets with the QR code and web address to our website at all our outreaching events.

Figure 8: A QR code that links to https://sites.google.com/site/massewaste/

The team monitored the traffic on our website through Google Analytics, which pairs well with our Google-hosted site as a sample analysis dashboard can be seen in Figure 9. Goggle Analytics allowed our team to keep track of how many visits, how long they spent on our site and from where they accessed the website.

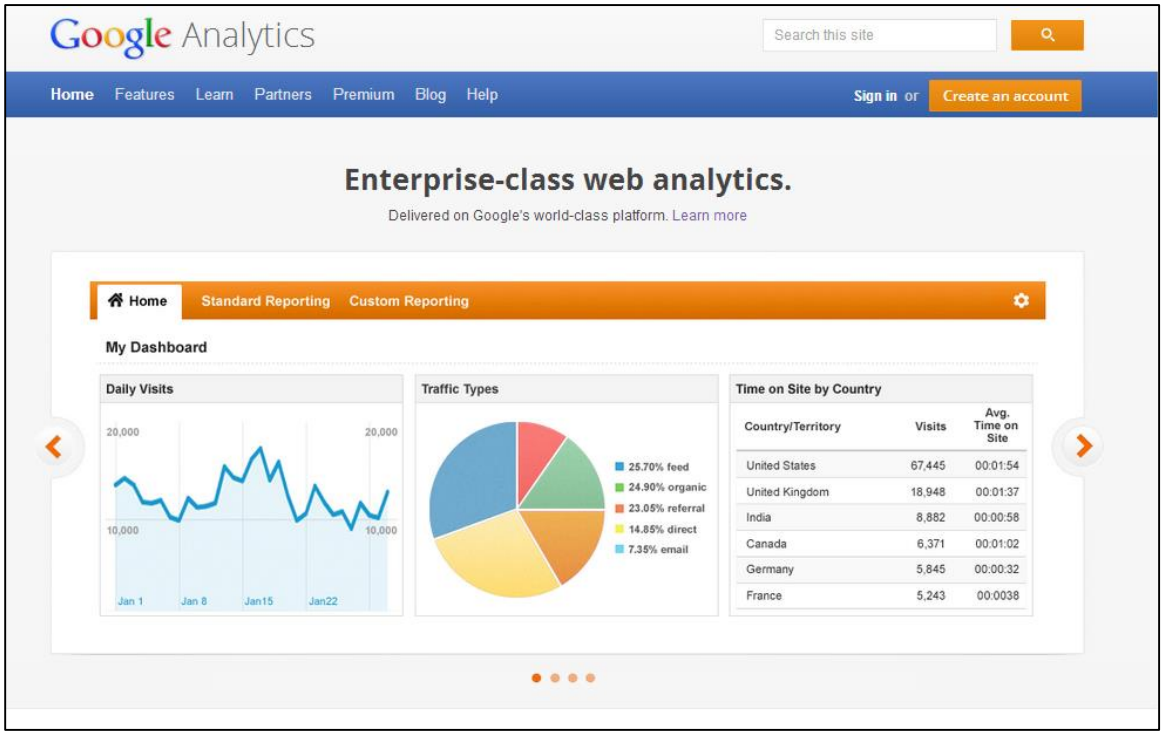

Figure 9: A sample display of Google Analytics Monitoring sites

We tracked visitors to the site for 31 days (3/20/2013 – 4/31/2013) during our time of public outreach events and campus visits. Once our project term had concluded, primary responsibility over maintaining our website was handed over to Clean Water Action. We provided them with the necessary information to access, modify and develop the website. Currently, there are sites like http://www.dontwastemassachusetts.org/, which is maintained by Lynne Pledger at Clean Water Action. It focuses on all different types waste

and legislation. However, our website is unique because it solely focuses on the issue of E-Waste within the Commonwealth of Massachusetts.

Further, while gathering ideas and designing our website we came across Campaign for Recycling and Clean Water Action websites. Campaign for Recycling is a non-profit organization dedicated to reducing waste and expanding recycling laws in the United States. Clean Water Action is a national citizens' organization working for clean, safe, and affordable water, and prevention of health-threatening pollution. Both organizations break down E-Waste laws by state, detailing their current standards for disposal. On their representative Massachusetts pages, a petition is available for supporters to sign on our website with map of Massachusetts separated by district. These organizations addressed this petition to Governor Deval Patrick calling for residents to "Take Action Now." Residents simply need to fill in their zip code, name, address and email to send the petition. We have devoted an entire page that connects our website to the petitions for site visitors to fill out. We used the petition to Governor Deval Patrick as a model to develop our own questions aimed at state legislators and residents of Massachusetts. Our contacts, Elizabeth Saunders and Lynne Pledger at Clean Water Action, helped the team clarify the different contents and writing styles of E-Waste bills in this legislative session. Our sample interview questions can be found in Appendix E. These environmental advocate groups helped bolster and provide necessary feedback for our implementation of the education and policy plan. Therefore, our last page was devoted to additional links for visitors to gain more insight on E-Waste policy. This page connects visitors to Basel Action Network, U.S. EPA, MassDEP, Clean Water Action and scholarly articles about E-Waste. This essentially made our website a 'gateway' for anyone desiring to learn about E-Waste in Massachusetts.

3.3.2 Outreach to the Technology Generation

Our team chose to focus on college students while gathering opinions and education about E-Waste and E-Waste legislation. Current college students are often referred to as the technology generation as they will not only produces the most E-Waste but also will live to see the repercussions if the issue is not addressed. As a team of college juniors, other college students were very receptive to the information we had to share and willing to participate in our project. For these reasons the college students made an ideal target demographic for our outreach efforts and are likely advocates for legislation.

The project team identified three schools to visit while gathering data and performing outreach. We began by identifying schools that had the highest percentage of in-state residents. By focusing on these schools, we had access to students that would be directly affected by E-Waste legislation and could legitimately petition their legislature to support passage of a strong E-Waste bill. After using collegeboard.com to identify the schools that had over 90 percent in-state students, we connected with these schools through MassPIRG chapters' Facebook pages. Finally the team decided travel to University of Massachusetts Dartmouth (96% in-state students) and the University of Massachusetts Boston (95% in-state students).

While Worcester Polytechnic Institute (WPI) only has 47% in-state undergraduate students in attendance, the team decided to focus our efforts here for the ease of connection and the fact that WPI is known for its' students outstanding project work and support for these projects. While the percentage of in-state students may not be extremely high, we were confident that we would receive a large response rate. At WPI the team also chose to become involved in the "Closer Look" Open Houses that are held for all accepted students for the upcoming academic year. This gave us access to families as well as college students who were interested in learning about WPI's projects. We were also able to send out emails to the entire student body and faculty of WPI about our survey and website to increase our reach.

During our campus visits to UMass Boston and UMass Dartmouth, gained support for E-Waste recycling and legislation through interaction with the students on campus. With the help of the MassPIRG chapters we booked a table in the student centers on both campuses. We brought our poster, found in Appendix F, to use as a reference when educating students about E-Waste as well as iPads and laptops so interested students could access our website and survey. We also utilized incentives. While students were welcome to approach us, we engaged them directly to ask if they would like to participate in our survey for a chance to win a Dunkin Donuts gift card during low traffic times. Similarly, at WPI we displayed our poster and provided access to the website and survey, but took more of an active role inviting people to come up and see our table as our friends, professors, and families walked by.

3.3.3 Outreach to Environmentally Aware Residents

In addition to college students, we wanted to educate and gather support from those who already have an interest in recycling and preserving the environment. One hurdle of E-Waste legislation is that many people do not realize that it is an issue or have no idea how to reach out and voice their opinion. Residents attending WPI's electronic waste recycling drive and the EcoTarium's Earth Day Celebration already have an interest in environmentally conscious living and by association, recycling. By targeting this demographic we were able to gather support from likely advocates of E-Waste legislation.

WPI has an electronic waste drive twice a year open to all students and faculty on campus. The goal of this event was to gain support on campus for E-Waste legislation and draw attention to the issue. We chose to attend this event for multiple reasons. WPI was an excellent target because it is considered a science, technology, engineering, and math focused school where the community uses multiple electronics in their day to day lives. Students would able to take the knowledge acquired about E-Waste into the work force with them after they graduate. The drive was advertised by the WPI Green Team and attracted many members of the WPI community that were already interested in recycling their products and would advocate for legislation. In an effort to further increase attendance, we forwarded emails to the email aliases of the organizations we are involved in on campus.

At the event, the team helped collect and sort all types of electronic waste. As people drove up in their cars our team would unload and sort the old electronics participants brought with them. As we unloaded the products, we had iPads on hand and asked participants to take our survey for the event, provided in Appendix A. As the sorting happened, we had the opportunity to answer questions about E-Waste recycling and the proposed E-Waste bills.

Another event attracting environmentally aware residents is the EcoTarium's Earth Day Celebration. The EcoTarium in Worcester hosts one of Worcester's most popular Earth Day celebrations for families across central Massachusetts. This event is extremely well attended and already organized with half price admission, environmental vendors and exhibitors, the Worcester Sharks Hockey team, radio stations, and even Disney characters, attracting all different types of families. By attending this event our team was able to reach a demographic that was untapped by our college visits.

The main focus of our attendance was to educate attendees about electronic waste and spark interest in families to recycle their E-Waste. We brought our poster and iPads to make our surveys and website available to show families where, when, and how they can recycle. We also spoke to the other environmental groups and venders who would be interested in advocating, signing petitions, filling out surveys, and helping out the E-Waste cause. Our team's last goal was to teach high school students about the importance of recycling.

3.3.4 Auburn High School Earth Day

Another WPI Worcester Community Project Center student group held an Earth Day informational event at Auburn High School. The team organized this event with the intent of educating high school students on, among other things, E-Waste recycling and the dangers of throwing computers in the trash.

4 FINDINGS & DISCUSSION

Through our methodology, we explored the current environmental and societal issues associated with E-Waste and discovered the current state of E-Waste legislation in the Commonwealth of Massachusetts. Our goal was to facilitate the passage of comprehensive electronic waste legislation. Our team has a total of eight claims that need to be considered as bills S357, H803, and S386 move through the State Legislature in the year 2013.

4.1 Policy Findings

Our team created a matrix of the current Massachusetts E-Waste bills S357, S386, and H803. We found that S357 has stronger provisions for creating recycling infrastructure, educating the public, and enforcing fines and penalties for those companies that do not recycle safely. Next, we examined a provision for joint and several liability in S386. Joint and several liability is explained in Section 2.3. The provision in S386 calls for the producers of a product to be jointly and severally liable for the recycling costs of their products, if more than one producer contributes to the manufacturing of the product. However, joint and several liability would also play a role in the larger recycling system, if collectors, processors, and producers were all liable for contracting with companies that recycle safely. Finally, from the case study of New York State in section 2.5.3, we found that the legislators chose to include a provision in their law that bans E-Waste from the normal waste stream. Our team found that a waste ban on E-Waste was overwhelmingly supported by the Massachusetts public, when it came at no cost to the consumer. Together, these findings constitute the five-point plan (Appendix G) that was presented at the Public Hearing before the Joint Committee on the Environment, Agriculture and Natural Resources.

4.1.1 Infrastructure

Recycling, as seen in section 2.3, involves more than just the breaking down and reusing of materials from end-of-life products. Indeed, the ideal recycling process is a dynamic process involving the consumers, collectors, processors, recyclers, and producers. Together, they form a recycling infrastructure to move products from the waste stream into the recycling stream and put the materials they contain back into use. However, there is room in this dynamic for fraud. Any of the parties in the recycling dynamic can exploit the

system and reap a profit by disposing of their products in an unsafe manner. Bills S357 and H803 have provisions in them that require collectors and processors to register with the Massachusetts Department of Environmental Protection, which would significantly reduce the chances for fraudulent activity. Bill S386 does not contain provisions for collectors or processors. A comparison of the infrastructure in S357, S386 and H803 is provided in Table 5

Table 5: Comparison of infrastructure in bills H803, S357 and S386

Producer Responsibility Bills	Subject	Registering & Obligations	Manufacturers & Producers	
	S357 Eldridge		• register with the department for twelve month periods for the first thrity-six months • pay renewal fee as established by the department • re-register no more than 60 days after registration expiration • Submit report with: name and contact information, past and present brand names of product, methods of sale, baselines for recycling and "green" product efforts	
	S386 Pacheco		• adopt and implement a collection and recycling plan • either individually or with other manufacturers • provide a copy of such plan to the department • affixe a permanent, readily visible label to the covered electronic euipment with the manufacturer's brand • pay the annual registration fee • met its annual collection amount for the previous year & pay any fees • Not responsible for any personal data on products	
	H803 Smizik		Same as S357	
Producer Responsibility Bills	Subject	Registering & Obligations	Collectors	Processors
	S357 Eldridge		• register with the department • register every 3 years, with a renewal fee (except for municipalities) • re-register no more than 60 days after expiration • Submit report with: name, contact information, location of business	• register with the department every 3 years, with a renewal fee (except for municipalities) • re-register no more than 60 days after expiration with the name, contact information, location of business of the applicant • Submit report with: name, contact information, location of business • use e-Steward recycler
	S386 Pacheco		Does Not Apply	• use e-Steward recycler
	H803 Smizik		Same as S357	Same as S357

One noteworthy piece of information is that all three bills have provisions that mandate processors either are e-Steward or R2 certified, or contract with certified companies to do business.

4.1.2 Education

Recycling programs cannot be successful without informed participants. In section 2.5, we discussed two states that have provided a multitude of ways for the public to learn about recycling E-Waste. In both states, the state environmental agency is responsible for providing information to the public about how, when, and where to recycle. Bill S386 from Massachusetts also contains a provision that makes the MassDEP responsible for educating the public, as seen in Table 6.

Table 6: Role of the MassDEP in bills H803, S357 and S386

Producer Responsibility Bills	Subject	Role of DEP	DEP Annual Task
	S357 Eldridge		• Submit an annual report with market share • Department can amend rules and regulations • Provide a list of manufacturers, collection events, collection sites and community collection and recycling programs • Submit additional reports to Senate/House Ways&Means & Joint Env. Committee containing: • Detail administrative costs to state and local governments, incentive for manufacturer collection, education, outreach, marketing efforts by state or local govs to promote collection
	S386 Pacheco		• Determine market shares for manufacturers by March 15 • Develop statewide goals from data collected from manufacturers • Provide a list of collection events, collection sites and community collection and recycling programs • Educate consumers about collection and recycling for covered electronic equipment • Create Electronic Waste Trust Fund, controlled by the DEP from the collection of underachievement fees, to bare the admintration cost
	H803 Smizik		Same as S357

However, relying on the MassDEP to educate the public will not be the most effective approach. Especially in 2013, with constantly increasing reliance on social networking sites and newly evolving means of communication, education would be most effective when supplemented by companies that have already investing in developing communication with the public. In bills S357 and H803, there is a provision that also makes retailers responsible for educating the public, as seen in Table 7.

Table 7: Role of retailers in bills H803, S357 and S386

Producer Responsibility Bills	Subject	Retailer Responisiblities	Retailers
	S357 Eldridge		• accepts products from: households, municipalities, small businesses, schools • contract with processors to receive products • keep a record of transaction for 3 years • make imformation for the public for where and how to return products • accept all covered products, limited to 5 • comply with federal EPA laws and others • NO fee for collection and NO knowingly except imported products for the purpose of discarding
	S386 Pacheco		Does Not Apply
	H803 Smizik		Same as S357

Retailers can be stores like Best Buy or producers like Apple that sells their products directly. In either case, large companies already invest in advertisements, so the lines of communication between companies and consumers already exist. In Washington State, they mandate that retailers provide information at the time of sale to consumers on recycling options (E-Cycle, Washington). Additionally, Washington State's legislation mandates that producers have clear labels on their products about where to recycle and provide information at the point of sale (E-Cycle Washington). In conclusion, educational information should be available at time of purchase and be labeled on the electronic products themselves, in addition to having this information available on websites. These are important attributes that should be instituted in Massachusetts.

4.1.3 Enforcement

At both the Federal and State levels of government, legislation is used by legislative branch to create a basic set of rules, which are then enforced by the executive branch. The MassDEP is an extension on the executive branch that will be charged with enforcing E-Waste recycling legislation, no matter which bill becomes law. The wording of legislation will dictate the extent to which the MassDEP will be allowed to create, remove, edit or implement regulations. It is important to have strongly worded legislation, especially regarding fines, so the MassDEP can affectively enforce the provisions of the law, as described below in Table 8.

Table 8: Comparison of penalties and goals in bills H803, S357 and S386

Producer Responsibility Bills	Subject	Enforcement	Audits & Fines	Goals	Collection Goal	Double Counting
	S357 Eldridge		• Violations shall be charged up to $25,000 as determined by the Department, with each day counting at separate violations • No fees for registration over $5,000		Deteremined by the DEP	Does Not Apply
	S386 Pacheco		• Only manufacturers may be audited, with 1st violation up to $10, 000 and following violations up to $25000 • Persons may be fined with 1st violation up to $1,000 and following violations up to $2,000		• 6.0 lbs of capita for the first three years • After, adjusted by the DEP if needed.	• municiple collection counts as double the weight towards recycling goal • reuse counts as double the weight towards recycling goal
	H803 Smizik		Same as S357		Same as S357	Does Not Apply

In law, there are often stark differences in small words. For example, notice in Table 8 that S357 has the word "shall," whereas S386 has the word "may" Legally, this is the difference between a provision that could hold up in any court of law and a provision that can be endlessly debated. Senate Bill 357 provides much more authority to the MassDEP for penalties when an infraction occurs.

Another aspect of enforcement is the range and type of products that are considered E-Waste. These products are defined in the bills as either "covered products" or conversely "exempt products." Overall, all three bills cover computers, monitors, televisions, and printers. However, S357 has many more products in addition to these basic electronic products, as seen in Table 9.

Table 9: Comparison of covered electronic products in bills H803, S357 and S386

	Subject		Covered Items			Exempt items
Producer Responsibility Bills	S357 Eldridge	Definition of E-Waste	Computer Products: • laptop • desktop • netbook • printers • portable calculator	Television Products: • TV's and anything that contains a tuner • Must be 9 inches or greater	Additional Products: • printers • fascimile machines • videos • video recorders & players • external hard drives • scanners	• any part of motor vehicles • industrial equipment • medical equipment • governmental equipment • commercial equipment • research equipment
	S386 Pacheco		Computer Products: • desktop • monitor • printer	Same as S357	None	• cell phones • cars • Global Posiitoning Systems (GPS) • servers • professional workstations • hand-held calculators • cables • mouse & keyboards
	H803 Smizik		Same as S357	Same as S357	Same as S357	Same as S357

Furthermore, S386 has more explicitly exempt items than S357. The MassDEP does not have any authority to amend law, so when S386 explicitly defines numerous exempt items the MassDEP loses its ability to amend and expand its policies. Most of the exempt items in S357 stem from large companies and governmental entities, which often have their own means of recycling.

In order to address this issue of adaptation and implementation, S357 has a provision that establishes an Advisory Committee, headed by the Chairs of the Joint Committee on Environment, Agriculture, and Natural Resources, with representatives from the MassDEP, environmental advocacy groups, and each of the electronics industries covered in the bill. This Advisory Committee would be tasked with reviewing Massachusetts's E-Waste recycling program and making recommendations for adding covered products to regulations, seen in Table 10.

Table 10: Role of the Advisory Committee in S357

	Subject		Members of Committee	Committee Tasks
Producer Responsibility Bills	S357 Eldridge	Advisory Committee	• Commissioner of the Department or his designee, for electronic waste • Senate & House chairs of the Joint Committee on Environment, Natural Resources, and Agriculture • One individual from to be appointed by the Secretary of Energy: television product manufacturer, processor of electronic products, trade association of computer product manufacturer, computer manufacturer, retailer of electronic products, Massachusetts Municipal Association, Massachusetts Product Stewardship Council.	• Advise the Department on policy, program development and performance standards • Review the registration and renewal fees for producers, collectors and processors • Make recommendations of amending the definition of electronic products • Meet at least four time annually • Department records meeting
	S386 Pacheco		Does Not Apply	Does Not Apply
	H803 Smizik		Does Not Apply	Does Not Apply

For example, none of the three bills currently cover mobile telephones, although this is an increasing source of E-Waste, as seen in section 1.1. With the Advisory Committee, mobile telephones may be added to the recycling program in years to come.

4.1.4 Joint and Several Liability

In section 2.3, we discussed joint and several liability. This means that when more than two defendants in a lawsuit, such as when there are multiple manufactures being taken to court for not complying with recycling regulations, the plaintiff can seek full recovery from just one of the defendants. This serves well in cases where one defendant ceases to exist, such as in the case of bankruptcy, or as discussed previously, in the case where one party simply vanishes.

Senate Bill 386 has a provision under the definition of "manufacturer" that calls for joint and several liability in the case of multiple manufactures for one product. If the MassDEP audits and finds a violation, they can seek recovery from any of the companies that contributed to the creation of the product. This provision would encourage manufactures to conduct business with reputable companies. A full comparison of the definitions of manufacturers (S386) and producers (H803 & S357) is provided in Table 11.

Table 11: Comparison of definition of producers & manufactures in bills H803, S357 and S386

	Subject		Manufacturers (S386) or Producers (S357 & H803)
Producer Responsibility Bills	S357 Eldridge	Definitions of Stakeholders	• manufactures a product under its own brand or label • sells a product under its own brand or label • owns a brand that it licenses to another person for use • imports a product that was manufactured by a person outside the US • sells at retail a product aquired from an importer
	S386 Pacheco		• manufactures a product under its own brand or label • resells a product under a brand it owns or is licensed to use by other suppliers (including retail establishments) • imports into the US or exports from the US products for sale • sells products acquired from an importer and elects to register in lieu of the importer as the manufacturer • when more than 1 person is a manufacturer, any 1 persons may assume responsibility for and satisfy obligations & department may consider any persons to be responsible manufacturer
	H803 Smizik		Same as S357

However, joint and several liability should be expanded to include more than just the producers. If each of the stakeholders in the recycling process were held jointly and severally liable for the safe disposal of E-Waste, it would incentivize companies to contract

only with others that have safe business practices. In this way, state and federal governments would not have had to pick up the tab of the Californian recycler that abandoned hundreds of CRT's in a warehouse, as seen in section 2.3.

4.1.5 Banned Solid Waste

Unlike many other states, Massachusetts has had a ban on Cathode Ray Tubes for 13 years. According to the MassDEP, the waste ban on CRTs was effective because there was already infrastructure in place in Massachusetts. Private companies profited by recycling CRT's for the glass and lead they contain. The same can be said for E-Waste recycling today, as companies like Electronic Recyclers International, a certified e-steward, already recycles E-Waste and serves producers like Best Buy. According to a 2012 Columbia Law Article, New York State legislators chose to include a provision in legislation that makes E-Waste a Banned Solid Waste. This makes it illegal to throw E-Waste in the trash. In Massachusetts, banning E-Waste from the solid waste stream would put it on the same level as not just CRT's, but also things like leaves and yard waste. Of the 399 of Massachusetts residents that we surveyed, an overwhelming 92% were in support of a provision for banning E-Waste from the solid waste stream as seen in Figure 10.

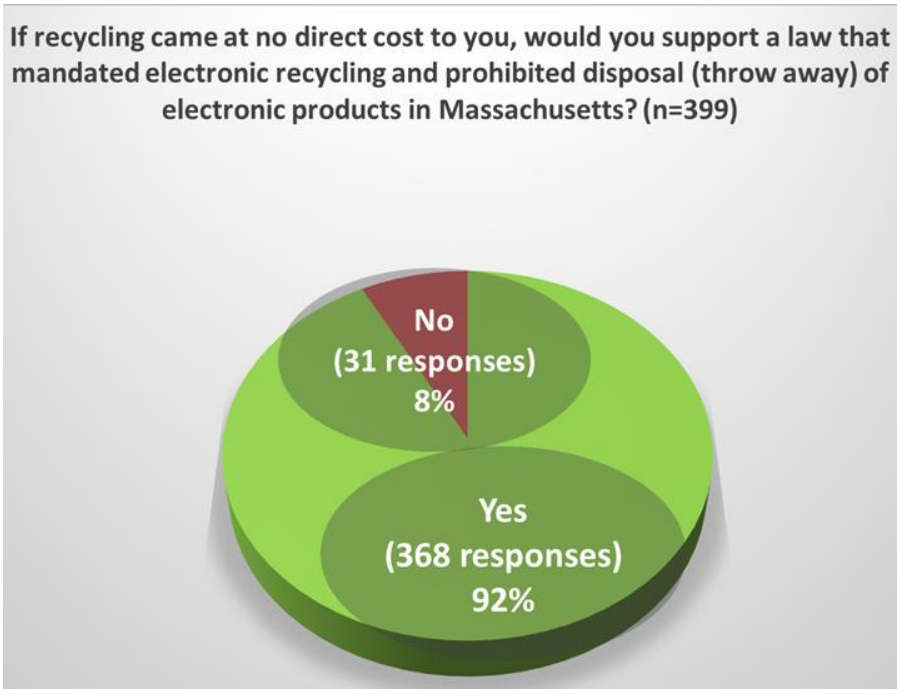

Figure 10: Percentage of MA residents that would support a ban of E-Waste from normal waste

There is already a solid waste ban in existence for products containing any amount of mercury. This covers most types of Liquid Crystal Displays (LCD's), most notably the flat-screen monitors found in many televisions and computers. However, much of the public is not aware that mercury is in these products or that mercury products are banned from the solid waste stream. E-Waste, itself a form of solid waste therefore it should be considered Banned Solid Waste.

4.2 Education Findings

We have surveyed college students and environmentally minded people across Massachusetts and have three main findings. First, Massachusetts residents understand that E-Waste is a growing problem; second, the overwhelming majority of those surveyed support Extended Producer Responsibility; and third that most survey participants support a curbside-pickup collection program.

4.2.1 Residents understand E-Waste is a Problem

Massachusetts residents believe E-Waste is problem for the state. Our website was visited by many Massachusetts residents. The use of the QR codes has proved to be very effective as we passed them out at many of our outreaching events. From Goggle Analytics, we gained a better understanding of the audience our website attracted. We attracted over 400 visitors in the time frame of approximately one month as illustrated in Figure 11.

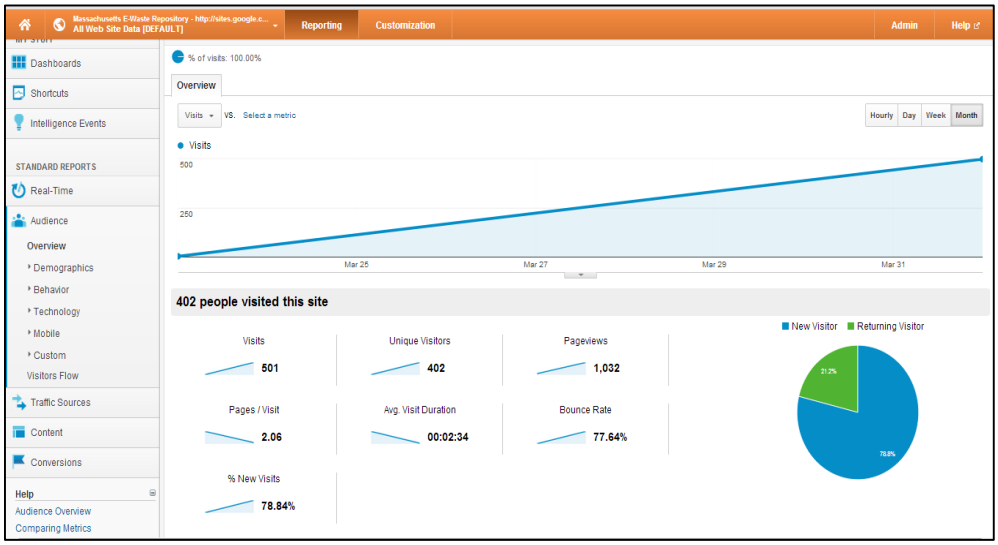

Figure 11: Number of visitors and page views of website

In addition, over 20% of these visitors returned to our website for a second visit. Even though our sole focus was in Massachusetts, we attracted visitors from across the

globe from places like Australia and Denmark. For our survey, we provided a screening question to assure we only gathered data from Massachusetts resident. Overall, we attracted over 494 visits from across the United States.

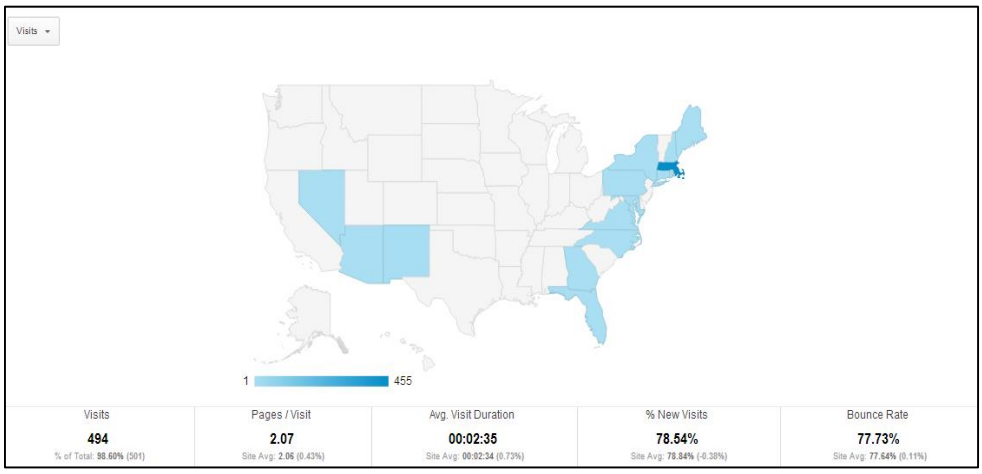

Figure 12: Visitors from across the United States

However, more than 90% of these visits came from Massachusetts itself as illustrated in by Figure 12. In Massachusetts, most frequent website visitors came from the following cities as shown below in Figure 13.

City	Visits
1. Worcester	355
2. Boston	42
3. Dartmouth	10
4. Charlton	3
5. Amherst	2
6. Cambridge	2
7. Framingham	2
8. Grafton	2
9. Holden	2
10. Leominster	2

Figure 13: Top ten cities with the most visits to website

This comes as no surprise; Worcester, Boston and Dartmouth are on top because these are the locations we primarily conducted college visits and outreach programs.

4.2.2 Producer Responsibility

Producer Responsibility is an essential component in E-Waste legislation. During our education and outreaching events, we surveyed Massachusetts residents to gain a better understanding of their opinion on producer responsibility.

For producer responsibility, we questioned on how much residents of Massachusetts are willing to pay per item for recycling their E-Waste. Our indications from our background research propelled the team to believe that residents will not want to pay much. The sole purpose of this question was to gear residents to develop a sense that they should not be responsible for E-Waste recycling. Our survey results confirmed this theory as over 80% of 399 Massachusetts residents surveyed desired not to pay more than $5 per item as seen in the Figure 14. In fact, no resident desired to pay more than $10 per item for recycling their E-Waste.

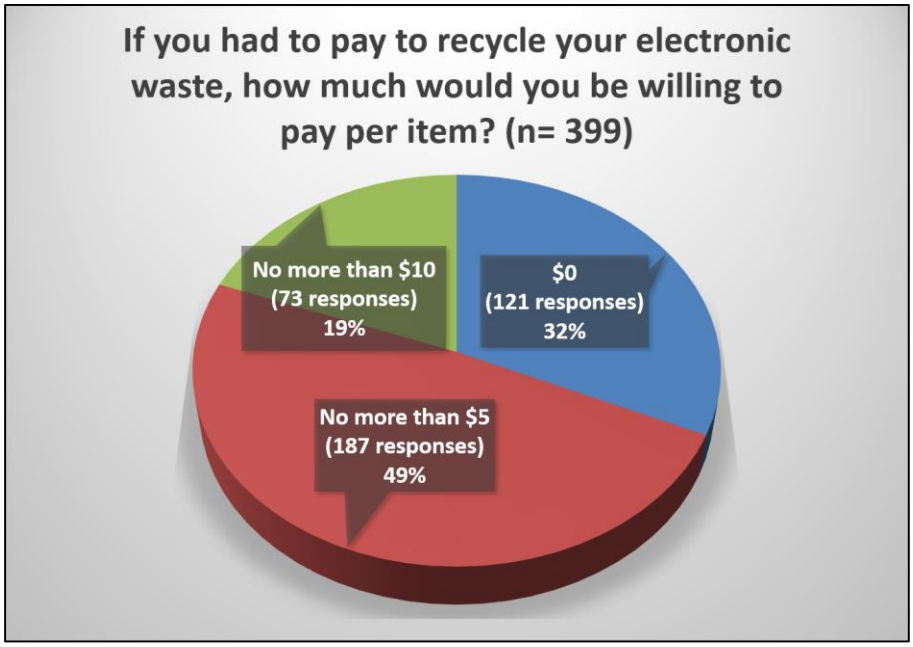

Figure 14: Maximum amount residents are willing to pay to recycle

Massachusetts residents believe producers should be financially responsible for the E-Waste produced. We asked the following question to gain a more insight on the Massachusetts residents' opinion on who should be held financially responsible for recycling E-Waste.

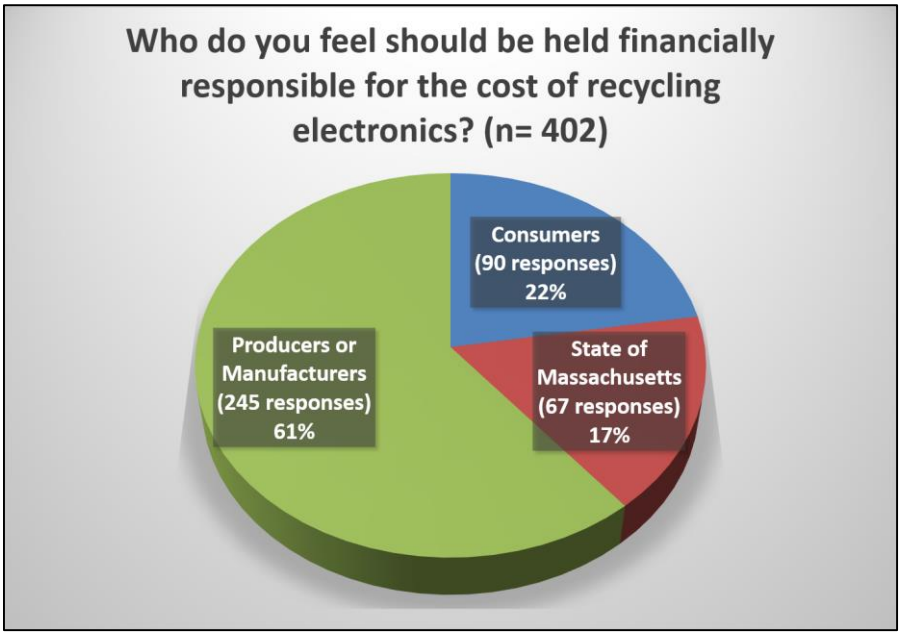

Figure 15: Stakeholder financially responsible for recycling E-Waste

It is clear that residents are in support of producer responsibility for the commonwealth of Massachusetts. Figure 16 provides the answers to our final survey question, asking participants whether they would suppor EPR legislation in Massachusetts.

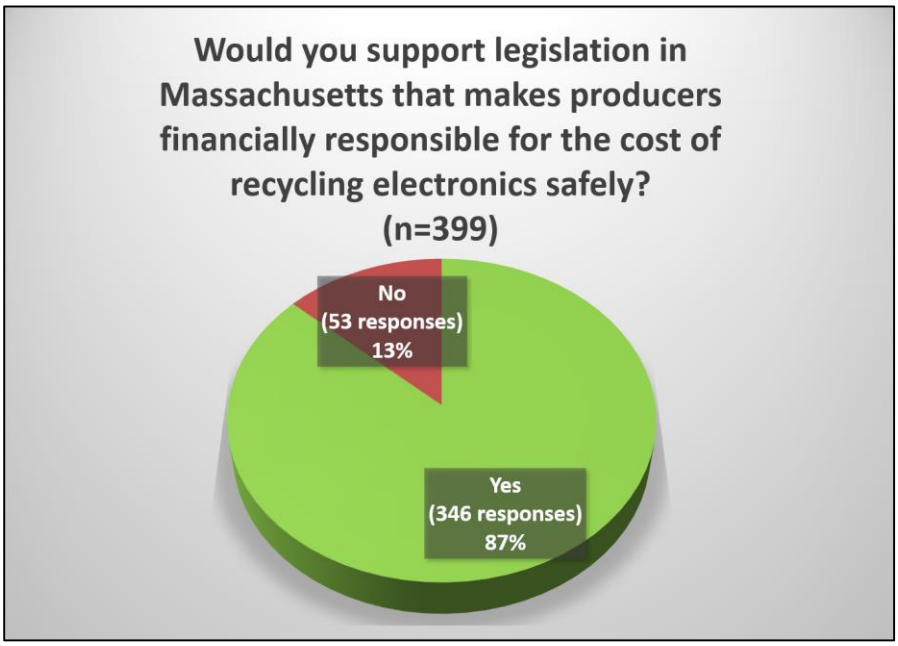

Figure 16: Yes or no on producer responsibility in E-Waste recycling

Our team's survey results validate that there is immense support, with 87% in favor of a producer responsibility law for the Commonwealth of Massachusetts.

4.2.3 Recycling Methods

Our survey results indicate that Residents of Massachusetts will always choose the most convenient option to recycle their E-Waste. Residents do not wish to spend much time recycling and effort dealing with E-Waste. The following histogram shows range of attitudes residents have on different methods of recycling in Massachusetts: curbside-pickup, throw it away (trash), recycling collection event, mail-in program, donate and drop-off locations, as reference in section 2.3.1. The data collected from surveys validated that curbside-pickup collection was the option residents would most likely use to recycle, as seen in Figure 17.

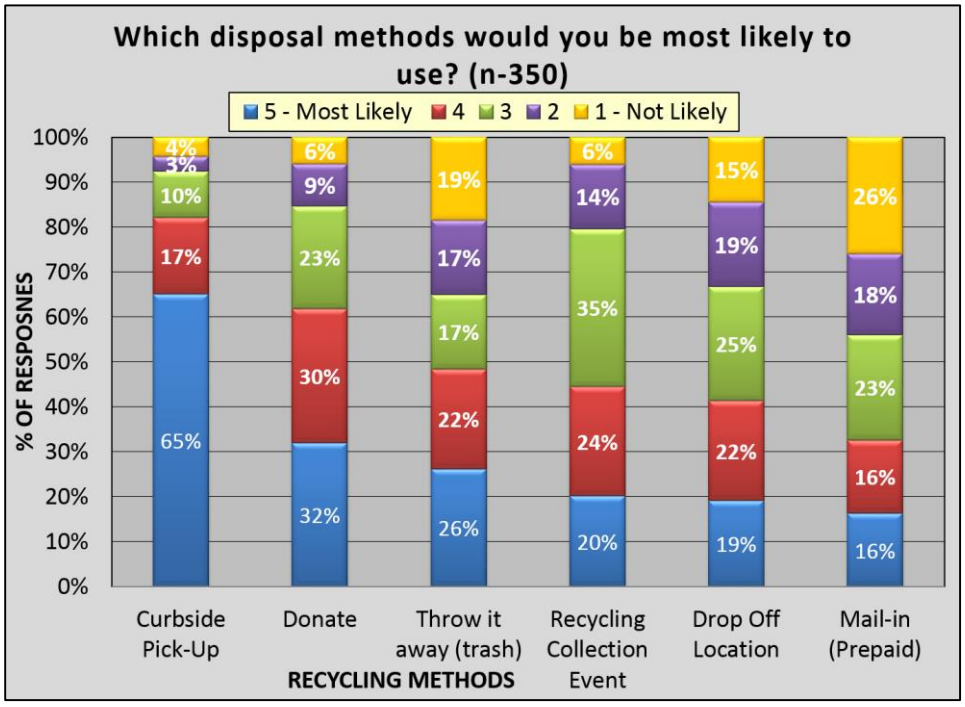

Figure 17: Likelihood of recycling by means of different types of collection

In contrast, the least likely option residents felt they would use is a mail-in program. This is due to the fact a mail-in program can become a complicated process and residents do not wish to spend much time on recycling their E-Waste.

A supplementary question was asked about how far a resident is willing to travel to safely recycle E-Waste. Our ideas were confirmed when our survey results, seen in Figure 18, showed 78% residents are only 1-10 miles to safely recycle their E-Waste. Further, only 9% of residents did not even desire to travel to recycle their E-Waste.

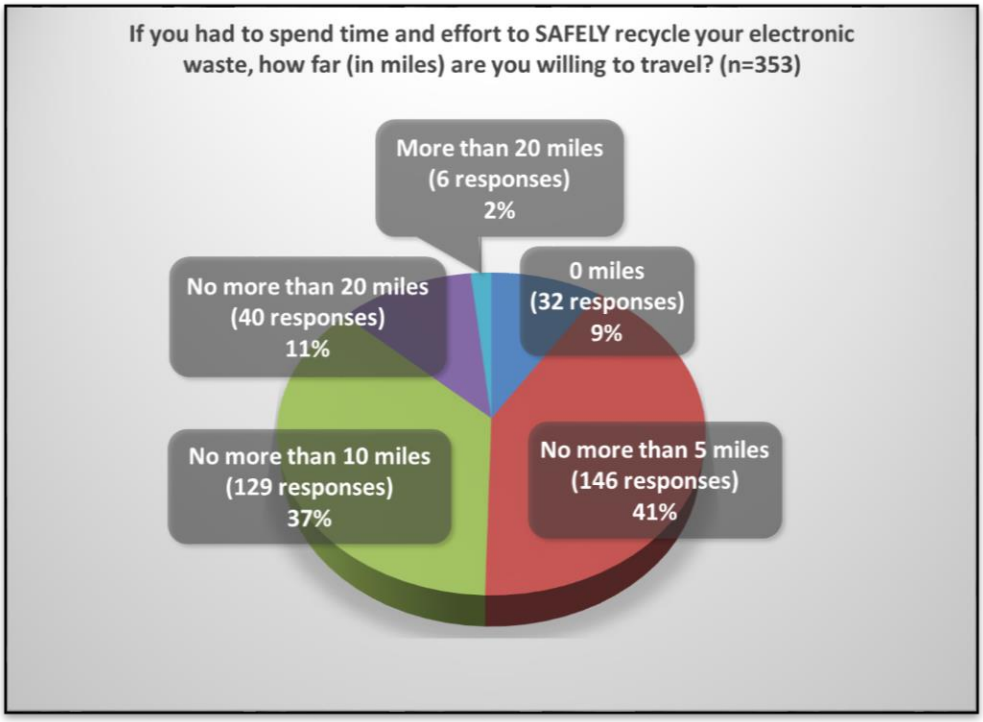

Figure 18: Maximum distance residents would travel to recycle E-Waste

These data reinforced our finding that Curbside Pick-Up is the most likely option residents are going to use to recycle their E-Waste. All response totals for our survey can be found in Appendix C.

4.3 Reactions and Connections

Our group received an overwhelmingly positive and supportive response to E-Waste legislation and our project. Our goal was to represent the technology generation. While we are engineering students, we wanted people to view us as representatives of those who will be around to see the repercussions of electronic waste and those who will use more electronics than ever before.

Our first event was the Public Hearing on Electronic Waste Legislation. Frequently, legislative public hearings are scheduled with little to no advance notice. This was true in our case. We were notified of the date of the hearing on Wednesday, March 20th, two weeks into our project and just six days before the hearing. As speaking time is limited to three minutes, we requested that our testimony be heard as a panel in order to create a fluid and comprehensive presentation. Each of the three group members focused on one aspect. Brianna gave introductions and spoke on the nature of our project at Worcester Polytechnic

Institute, limiting her testimony to about a minute. Chris following by describing two important pieces of information that the team discovered from background research; New York's Joint and Several Liability and Banned Solid Waste provisions as described in Section 2.5.3. Raj highlighted three points that should be required in any piece of E-Waste legislation: infrastructure, education, and enforcement. Finally, Brianna concluded our presentation with a summary of the five main points and an appeal to the pathos of the committee.

Our team was the first to testify. We nervously approached the table and began giving our testimony (Appendix G). To our pleasure, the committee was receptive. Numerous legislators told us how informative our recommendations were. At the end of the day, three bills were reported out of the Executive Committee Meeting after the Public Hearing. Senate Bill 386 by Senator Chandler, H803 by Representative Smizik, and S357 by Senator Eldridge were passed on to the Joint Ways and Means Committee, the three bills that contained our recommendations. Never before has E-Waste legislation been reported out of committee this early in the legislative session.

The team's next event, the Solid Waste Seminar we attended simply to observe and ask a few question at the end. This was our opportunity to garner additional knowledge from organizations like Clean Water Action, the Sierra Club, and the MassDEP. We sat among many legislators and constituents concerned with the issue of solid waste. Again we were taken by surprise when the representative from Clean Water Action recognized our team's strides and efforts towards strong legislation during her short 10 minutes to speak. At the end of the seminar many different people came up to speak with us about legislation, E-Waste, and our project.

As our team reached out to other stakeholders, we assisted Student Green Team and Liz Tomaszewski, WPI's Facilities Systems Manager/Sustainability Coordinator at an E-Waste drive our college campus to outreach to those who were already recycling. As people drove up with cars full of old televisions, computers, and other electronics they would tell us how convenient it was. They responded saying they were aware they could not just throw these items in the trash, but had no idea how to get dispose of them. As the event continued and the large piles of electronic waste continued to pile up, we began to see just how important the concept of reuse is. Slowly students began to wander over and

look at what we were doing. They would ask if they could look at the items and possible take any. As more students found out about the event; more and more students began to come over. We heard exclamations such as, "This is perfect for my robot!" and "I always wanted a second computer monitor!" Students and professors would drive up and unload unwanted electronics and drive away with new parts they could use. By the end of the day we had collected two tractor trailer trucks full of electronic waste (Appendix D) and generated discussion on E-Waste legislation for the Commonwealth of Massachusetts.

In the next step of our project, we outreached to UMass Dartmouth, UMass Boston, and WPI students. Everyone we spoke to was from Massachusetts and willing to take our survey. We had some conversations lasting over forty minutes and were able to answer many questions. Some students showed interest in having an E-Waste drive at UMass Dartmouth in the future. While we were at WPI during the open house days, prospective students, current students, and professors were even more receptive. We had parents and prospective students come up to inquire about project work at WPI and leave advocates for E-Waste recycling. Professors questioned us about what would happen to personal information on hard drives if recycled and were excited to hear that when recycled properly everything would be destroyed. Many people remembered us from the E-Waste drive and signed petitions to advocate for legislation.

Another significant response came from our outreach to the younger generation at the EcoTarium and Auburn high school. It was an amazing opportunity to apply our research to a younger audience. We spoke with children about what they thought should happen when their Gameboy no longer worked or they got a new television. It was an all-around positive day focused on the importance of saving our planet. At Auburn high school we were able to talk to kids electronic recycling and joining their school Green Team. At the beginning of the day, the Green Team had only 2 members, both who were graduating. After spending time going around and talking to students about how "cool" being environmentally aware can, the Green Team had 27 new members.

Through all of our efforts, we were able to establish connections and educate legislators, college students, children, parents, families, and many Massachusetts residents.

5 CONCLUSIONS

Based on this research study and findings, our team is confident that Massachusetts will pass an E-Waste recycling bill during the 188th Massachusetts legislative session. Our research from cases studies and comparison of bills H803, S357 and S386 indicate the need for the following provisions for robust E-Waste legislation: *Infrastructure*, *Education*, *Enforcement*, *Joint and Several Liability* and a *Solid Waste Ban on E-Waste*. There is a tremendous need for E-Waste legislation within the state because of the harmful societal and environmental effects associated with improperly disposing of E-waste in landfills or incinerators or illegal exportation to foreign countries. Producer responsibility is the most effective model of E-Waste legislation that Massachusetts can use as 26 states have successfully passed a form of producer responsibility law for recycling E-Waste. As shown in Figure 15, 61% of survey responses favored manufacturer or producer responsibility and 39% favored other parties. We concluded that residents feel strongly that the manufactures and producers should bear the E-Waste recycling cost. The majority of people we surveyed are aware that E-Waste recycling is an issue and support a mandatory ban on E-Waste from the normal recycling stream when it comes at no direct cost to them. Based on our data, residents of Massachusetts we surveyed strongly support the Extended Producer Responsibility model for Massachusetts E-Waste recycling legislation. Residents are willing to pay a small cost and travel a short distance to safely recycle their E-Waste, but prefer the option of curbside-pickup collection.

6 RECOMMENDATIONS

The team made great strides towards our goal in the successfully passing E-Waste legislation for the state of Massachusetts. We focused on setting the grassroots by studying the various forms of E-Waste legislations across the globe. The following recommendations are for others to take the initiative and make a difference.

(1) **Our recommendation to Massachusetts legislators is that Massachusetts needs a progressive bill on E-Waste to pass.** The EPR bill should address infrastructure, education, enforcement, a solid waste ban and joint and several liability.

- ***Infrastructure*:** specifically a way to track parties involved in recycling as well as an Advisory Committee of legislators and experts to adapt the program as it develops
- ***Education*:** a multitude of ways for the public to learn of the program, especially in the early stages, which requires a combined effort from manufacturers and government [1]
- ***Enforcement*:** a system to catch fraudulent activity and the legal weight for the Department of Environmental Protection to take action against infractions [2]
- ***Disposal Ban*:** a provision in legislation that makes e-waste a Banned Solid Waste, making it illegal to throw e-waste in the trash [3]
- ***Joint and Several Liability*:** a provision that will cover products that might have multiple producers manufacturing parts [4]

(2) **The team recommends others to use our project as a model to help raise awareness on E-Waste recycling and legislation.** Specifically, focusing on your target audience, legislators and the context of the legislations. Since only about half of the country has adopted the extend producer responsibility model for electronic waste, this study serves as a starting point for others to understand about E-Waste policy and education and

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[1] Templeton, N. J. (2012). The Dark Side of Recycling and Reusing Electronics: Is Washington's E-Cycle Program Adequate?
Seattle Journal for Social Justice, 7(2), 21.

[2] Urbina, I. (2013, March 18). Unwanted Electronic Gear Rising in Toxic Piles. The New York Times, pp. 1-2.

[3] Buseman, N. (2012). A second-generation solution to electronic waste: the New York approach. Columbia Journal of Environmental Law, 37(2), 245.

[4] Buseman, N. (2012). A second-generation solution to electronic waste: the New York approach. Columbia Journal of Environmental Law, 37(2), 245.

manipulate the model to fit their state's needs. It is about finding that balance between education and policy components. Our plan can be seen in Figure 19 below.

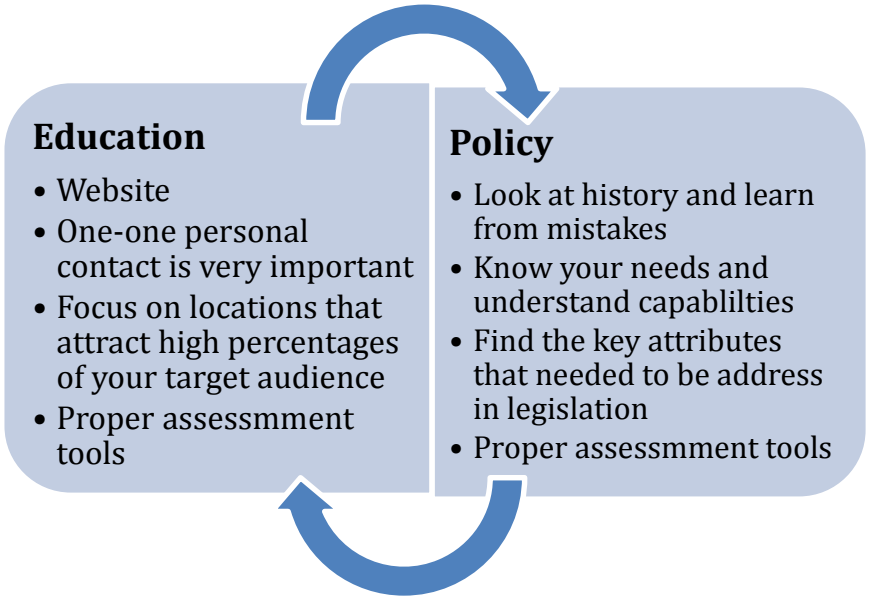


Figure 19: Plan for future legislation studies

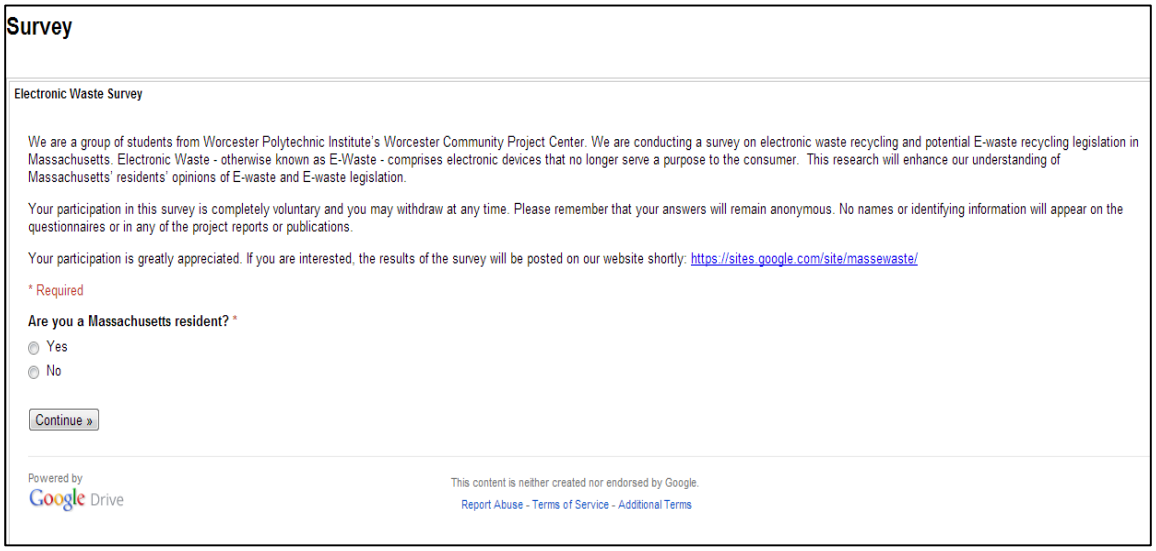
(3) **The team advises others to use our research as a gateway to understanding the importance and the effectiveness of a comparative analysis.** We researched case studies from Washington, California, Maine, and New York states to learn about E-Waste recycling legislation. For Massachusetts, we created a matrix of the three current pieces of E-Waste legislation that highlighted similarities and differences. Without analysis on previous studies and our matrix, the team would not have been able to identify the essential and non-essential information. As far as the team is aware, no party has had a similar approach to analyzing previous E-Waste legislation studies. Furthermore, this approach can be adapted for any type of legislation(s). In fact, theoretically, this particular method can be applied to any form of comparative analysis effort.

(4) **Future studies should focus on collecting more data.** Our interaction to residents needed to be short and simple because targeting residents during busy lunch hours. People spent an average of 1-2 minutes on filling out survey. In a more advance study, more thought provoking questions and possibly open ended questions need to be asked.

(5) **Future studies on E-Waste for Massachusetts should focus on ensuring effectiveness.** Particularly, focusing on the implementing a state program once legislation is passed. In fact, a potential IQP project team should conduct an "audit" on the legislation passed. Specifically, the project should look into the impact of policy and how effectively is the E-Waste recycling program from consumers to producers to recyclers in Massachusetts.

7 APPENDICES

7.1 Appendix A - Survey Questions



Survey

Electronic Waste Survey

We are a group of students from Worcester Polytechnic Institute's Worcester Community Project Center. We are conducting a survey on electronic waste recycling and potential E-waste recycling legislation in Massachusetts. Electronic Waste - otherwise known as E-Waste - comprises electronic devices that no longer serve a purpose to the consumer. This research will enhance our understanding of Massachusetts' residents' opinions of E-waste and E-waste legislation.

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will appear on the questionnaires or in any of the project reports or publications.

Your participation is greatly appreciated. If you are interested, the results of the survey will be posted on our website shortly: https://sites.google.com/site/massewaste/

* Required

Are you a Massachusetts resident? *

Yes

No

Continue »

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Electronic Waste Survey

Which of the following disposal methods would you be most likely to use?

Please indicate below how likely you would be to use each of the following disposal methods if they were available

Curbside Pick-Up

1 2 3 4 5

Unlikely Likely

Donate

1 2 3 4 5

Unlikely Likely

Drop Off Location

1 2 3 4 5

Unlikely Likely

Mail-in (Prepaid)

1 2 3 4 5

Unlikely Likely

Recycling Collection Event

	1	2	3	4	5	
Unlikely	○	○	○	○	○	Likely

Throw it away (trash)

	1	2	3	4	5	
Unlikely	○	○	○	○	○	Likely

If you had to pay to recycle your electronic waste, how much would you be willing to pay per item?

- ○ $0
- ○ No more than $5
- ○ No more than $10
- ○ No more than $15

If you had to spend time and effort to SAFELY recycle your electronic waste, how far (in miles) are you willing to travel?

- ○ 0 miles
- ○ No more than 5 miles
- ○ No more than 10 miles
- ○ No more than 20 miles
- ○ More than 20 miles

Who do you feel should be held financially responsible for the cost of recycling electronics?

- ○ Consumers (individuals who purchase and/or dispose of electronic products)
- ○ State of Massachusetts
- ○ Producers (companies who manufacture electronic products)

If recycling came at no direct cost to you, would you support a law that mandated electronic recycling and prohibited disposal (throw away) of electronic products in Massachusetts?

- ○ Yes
- ○ No

Would you support legislation in Massachusetts that makes producers financially responsible for the cost of recycling electronics safely?

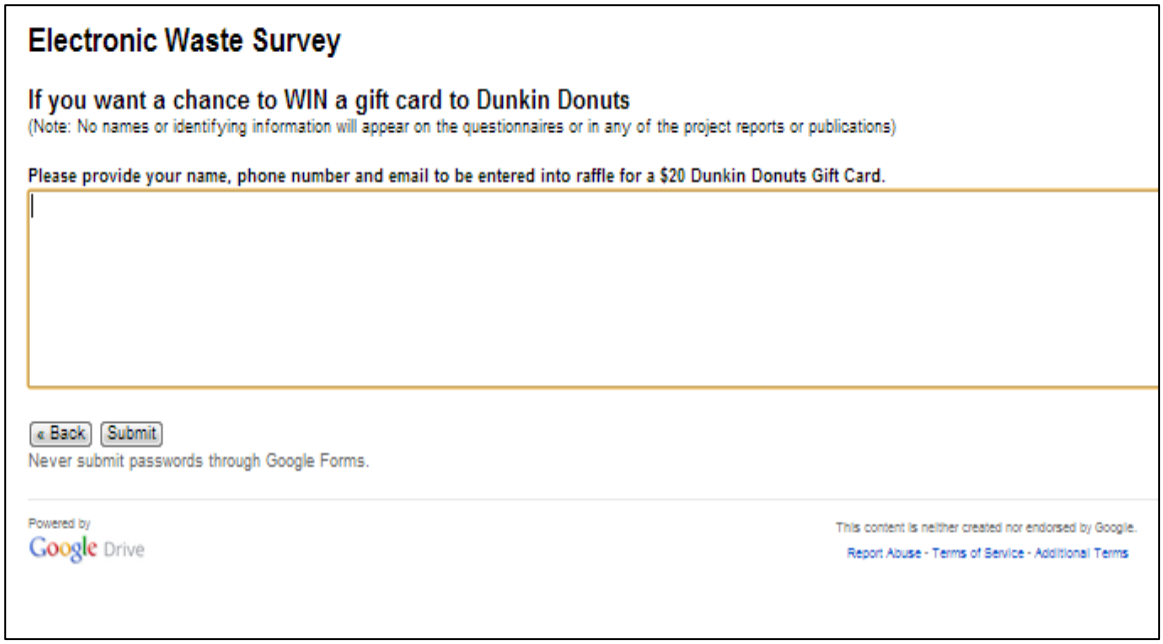
- ○ Yes
- ○ No

Petition your legislators to pass E-Waste legislation for the state of Massachusetts.

Click on the link below to fill out to petition your legislators

http://salsa.democracyinaction.org/o/2155/p/dia/action3/common/public/?action_KEY=6240

« Back | Continue »



Electronic Waste Survey

If you want a chance to WIN a gift card to Dunkin Donuts

(Note: No names or identifying information will appear on the questionnaires or in any of the project reports or publications)

Please provide your name, phone number and email to be entered into raffle for a $20 Dunkin Donuts Gift Card.

« Back Submit

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7.2 Appendix B – Website Pages

Categories	Some Examples
computers	netbooks, laptops and stand alone towers
fax machines/printers/copiers	industrial or personal size
mobile telephones	iPhone to RAZR
gaming consoles	Xbox, PSP, SEGA Genesis
radios	Portable, Automobile, and Home Systems
televisions/monitors	Any screen larger than 4" diagonally
DVD players	Blu-Ray players too

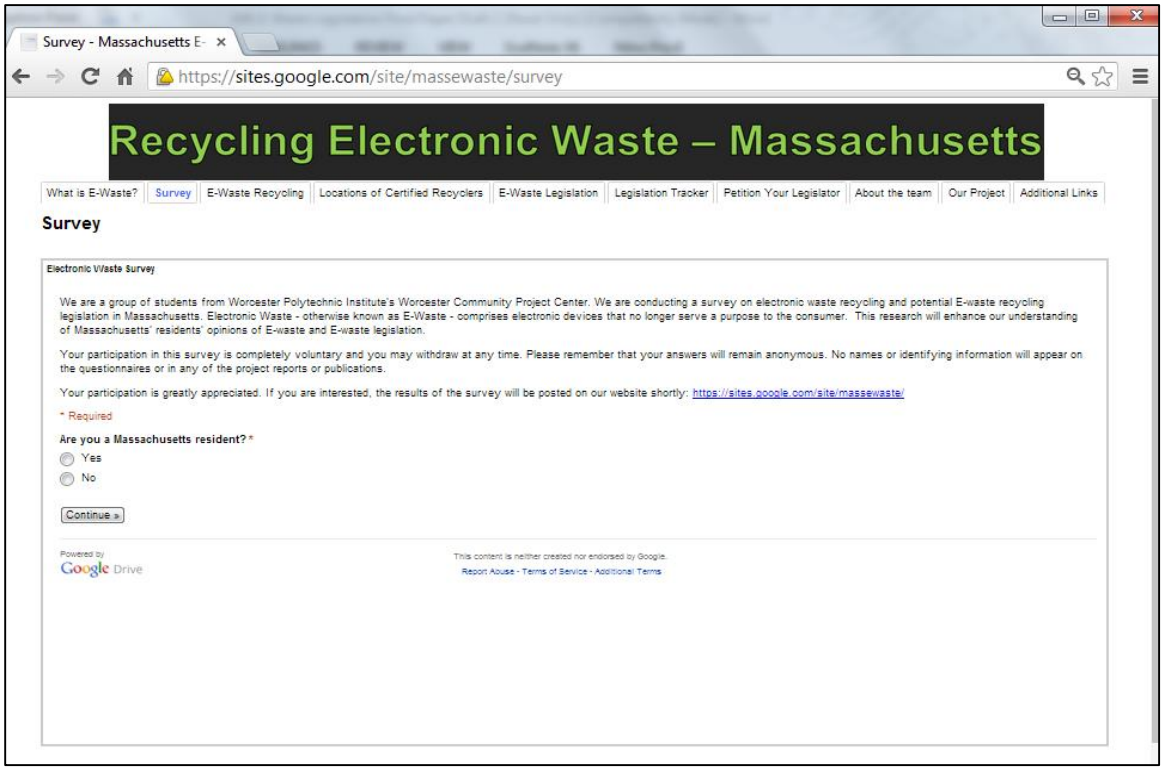


Figure 1: Paths of E-waste contaminants from producers to receivers and ultimately to humans (Robinson 2009)

While many see the proper recycling method as costly and time consuming, it is the only guaranteed way to a protect people from ingesting, inhaling, or coming in contact with hazardous materials that are known to cause severe health problems like various cancers as well as kidney, liver, and brain damage. Table 1 charts some of the hazardous chemicals contained in E-Waste, what they are used for in electronics, and the health hazards they can lead to when disposed of improperly (Cobbing 2008).

Table 1: Uses and hazards associated with selected chemicals in E-waste (Cobbing 2008).

Chemical	Use	Health Hazard
Beryllium	Springs, relays, connectors, motherboards	Lung cancer, acute and chronic beryllium disease
Cadmium	Laptops and computer batteries	Kidney and bone damage, heart disease, hypertension, lung cancer
Chromium Hexavalent	Metal housings	Skin reactions, cancer, kidney and liver damage
Lead	Printed circuit boards, cathode rays	Intellectual impairment in children, nervous, blood, and reproductive system damage in adults
Mercury	Lighting devices for flat screens, computer batteries	Central nervous system damage, kidney damage, heart disease
Brominated Flame Retardants	Circuit boards, plastic castings, mobile phones	Brain and skeletal development, permanent memory loss, delayed puberty

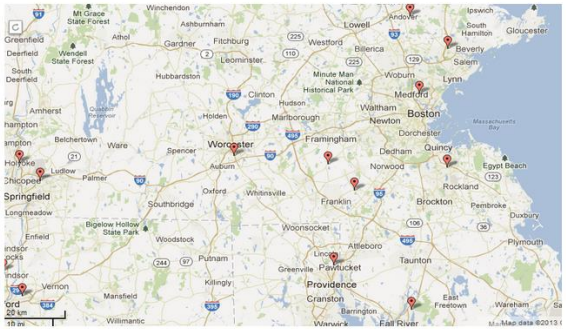
Image Source

Source
Cobbing, M. (2008). Toxic Tech: Not in Our Backyard. *Greenpeace International*
Robinson, B. H. (2009). E-waste: An assessment of global production and environmental impacts. *Science of the Total Environment, 408*(2), 183-191.

Locations of Certified Recyclers

e-Steward Certification - the highest standard of environmental responsibility and worker protection.

R2 Certification - a standard that includes general principles and specific best practices for Recyclers disassembling or reclaiming used electronic equipment.



[Complete Recycling Solutions, LLC]

Fall River, MA

[Electronic Recyclers International, Inc.]

Holliston, MA **(e-Steward Certified)**

[Electronix Redux Corp.]

Norfolk, MA

[Environmental Integrity Co, LLC]

Holyoke, MA

[Integrated Communications and Technologies, Inc.]

Malden, MA

[M&K Recovery Group]

North Andover, MA

[Metech Recycling, Inc.]

Worcester, MA

(e-Steward Certified)

[PCS of Massachusetts]

Weymouth, MA

[WM Recycle America, L.L.C. - eCycling Services]

Springfield, MA **(e-Steward Certified)**

[XTechnology Global]

Danvers, MA

https://sites.google.com/site/massewaste/e-waste-legislation

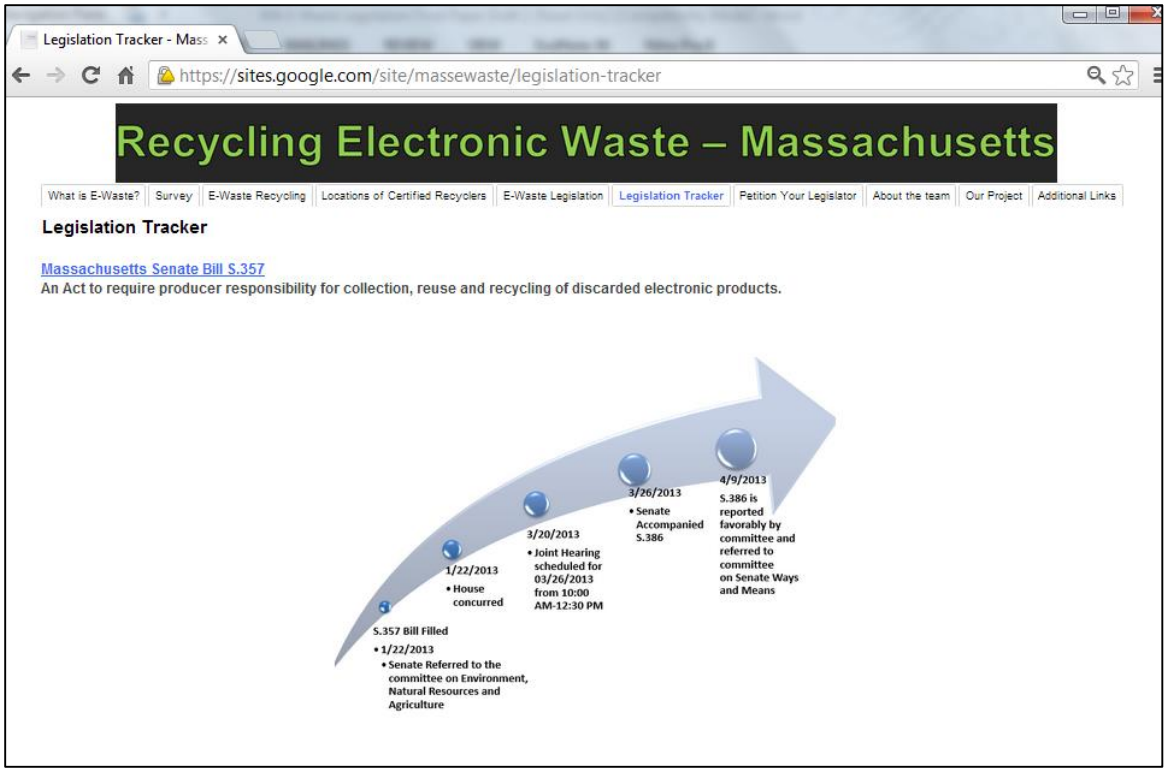
What is E-Waste? | Survey | E-Waste Recycling | Locations of Certified Recyclers | E-Waste Legislation | Legislation Tracker | Petition Your Legislator | About the team | Our Project | Additional Links

E-Waste Legislation

Although there is no current legislation in Massachusetts to mandate E-Waste recycling, several state legislators have directly sponsored related bills. Representing the 10th Bristol District in Massachusetts, William Straus is a member of the Massachusetts Hazardous Waste Facilities Site Safety Council. Previously, he worked directly with the EPA to prevent the government from incinerating waste and sending dangerous emissions into the environment (Representative Bill Straus 2013). Representative Robert M. Koczera is on the House Ways and Means Committee. He currently represents the 11th Britsol District of Massachusetts and sponsored a bill to reinstate the Clean Environment Fund that would protect the environment and reduce waste (Robert M. Koczera 2013). From the 15th Norfolk District, representative, Frank Smizik, chair of a new House Committee on Global Warming and Climate Change, has sponsored many bills involving issues affecting the environment (Frank I. Smizik 2013).

Finally, State Senator Jamie Eldridge sponsored multiple bills on E-Waste recycling policy in Massachusetts. He has been a leader in environmental and social justice issues throughout his time in the Massachusetts legislature. In 2012, he was Vice Chair of the Senate Environment Committee and worked to create the Water Infrastructure Finance Commission, which ensures that families will have clean drinking water for generations to come. He currently works to preserve funding for the Toxic Use Reduction Institute. Most importantly for the purposes of this project, he has sponsored multiple drafts of a bill called *An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products*. This legislation has the possibility to create a model E-Waste recycling program for the country. The E-Waste bill sponsored by Senator Eldridge has seen four major revisions since it was first introduced in 2010 (Act, 2013)

In 2013 or the 188th session, Senator Pacheco, Senator Eldridge and Representative Smizik have filled S.386, S.357 and H.803 bills respectively. Senator Pacheco's S.386 is *An Act relative to information technology producer responsibility* that focuses on setting guidelines for the producer to follow. While, Eldridge's bill and Smizik's bill filled are the latest versions of *An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products*. In order to find out recent updates on Massachusetts e-waste legislation, please visit our Legislation Tracker.


Legislation Tracker - Mass
https://sites.google.com/site/massewaste/legislation-tracker
Recycling Electronic Waste – Massachusetts
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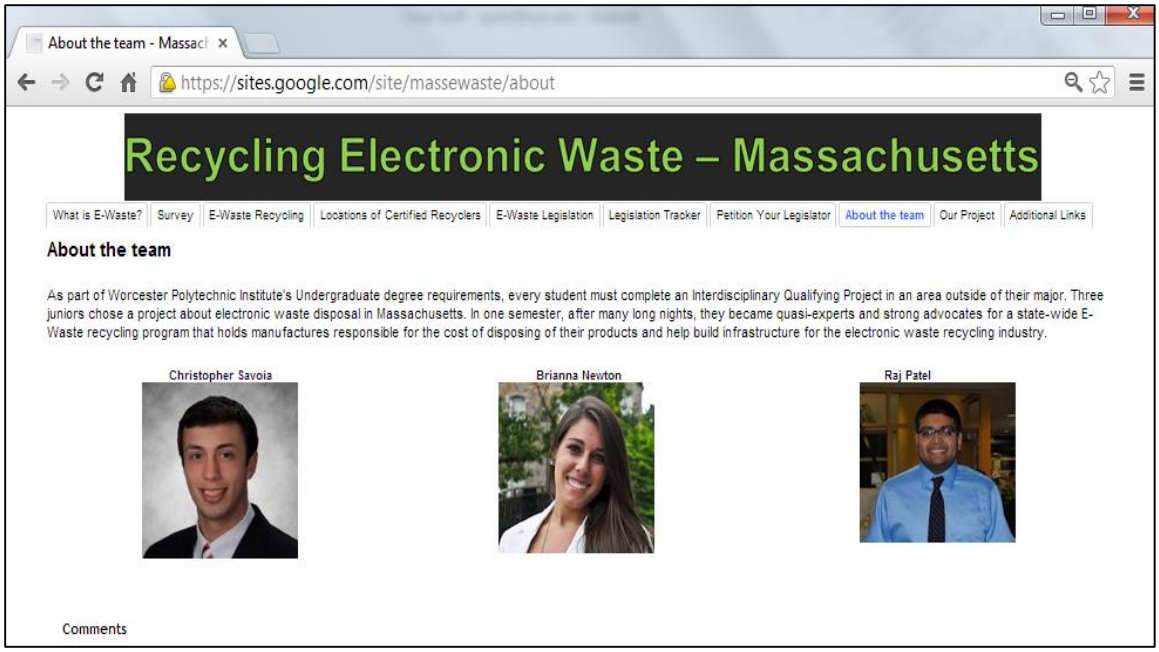
Legislation Tracker
Massachusetts Senate Bill S.357
An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products.
S.357 Bill Filled
• 1/22/2013
• Senate Referred to the committee on Environment, Natural Resources and Agriculture
1/22/2013
• House concurred
3/20/2013
• Joint Hearing scheduled for 03/26/2013 from 10:00 AM-12:30 PM
3/26/2013
• Senate Accompanied S.386
4/9/2013
S.386 is reported favorably by committee and referred to committee on Senate Ways and Means


Petition Your Legislator -
https://sites.google.com/site/massewaste/getinvolved
Recycling Electronic Waste – Massachusetts
What is E-Waste? | Survey | E-Waste Recycling | Locations of Certified Recyclers | E-Waste Legislation | Legislation Tracker | Petition Your Legislator | About the team | Our Project | Additional Links
Petition Your Legislator
Clean Water action, a organization working for clean, safe, and affordable water, and prevention of health-threatening pollution has a quick, easy petition that only requires your name and zip code.
The petition is sent to your state legislators from the zip code you provide and signed with your name.
The form is editable and you are encouraged to add your own remarks!
"Take Action Now:
Please write to your state legislators and Governor Patrick TODAY"
(Please click on the map of Massachusetts below to sign the petition)
Third District
Fifth District
Sixth District
Fourth District
Eighth District
Seventh District
Second District
First District
Copyright © 2012 All Rights Reserved
Website by Social Startup Partners
Sign In | Report Abuse | Remove Access | Powered By Google Sites


About the team - Massac
https://sites.google.com/site/massewaste/about
Recycling Electronic Waste – Massachusetts
What is E-Waste? | Survey | E-Waste Recycling | Locations of Certified Recyclers | E-Waste Legislation | Legislation Tracker | Petition Your Legislator | About the team | Our Project | Additional Links
About the team
As part of Worcester Polytechnic Institute's Undergraduate degree requirements, every student must complete an Interdisciplinary Qualifying Project in an area outside of their major. Three juniors chose a project about electronic waste disposal in Massachusetts. In one semester, after many long nights, they became quasi-experts and strong advocates for a state-wide E-Waste recycling program that holds manufactures responsible for the cost of disposing of their products and help build infrastructure for the electronic waste recycling industry.
Christopher Savoia
Brianna Newton
Raj Patel
Comments


Our Project - Massachuse
https://sites.google.com/site/massewaste/our-project
Recycling Electronic Waste – Massachusetts
What is E-Waste? | Survey | E-Waste Recycling | Locations of Certified Recyclers | E-Waste Legislation | Legislation Tracker | Petition Your Legislator | About the team | Our Project | Additional Links
Our Project
Currently, the team focuses on achieving the following goal and objectives:
Goal: To facilitate the passage of effective E-Waste recycling legislation in Massachusetts
• Increase awareness for E-Waste at the grassroots level
• Characterize the purpose and attributes of previous and pending E-Waste bills
• Interview and educate legislators on the pros and cons of previous E-Waste recycling programs
• Create a model for college students to characterize, publicize, and implement electronic waste in states without current legislation
To get a more insight on our project visit the E-Waste Team's Weekly Blog
Comments
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Additional Links - Massac
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Additional Links
Basel Action Network (BAN)
e-Stewards
U.S Department of Environmental Protection - eCycling
Massachusetts Deportment of Environmental Protection - Recycling E-Waste
Clean Water Action - Massachusetts
Don't Waste Massachusetts
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7.3 Appendix C – Data from surveys

	A	B	C	D	E	F	G	H
1	Q1	Who do you feel should be held financially responsible for the cost of recycling electronics?	Consumers	State of Massachusetts	Producers or Manufacturers	Total		
2	A1	Response	90	67	245	402		
3	Q2	Would you support legislation in Massachusetts that makes producers financially responsible for the cost of recycling	Yes	No		Total		
4	A2	Response	346	53		399		
5	Q3	Which disposal methods would you be most likely to use (other than this program)	Curbside Pick-Up	Donate	Drop Off Location	Mail-in (Prepaid)	Recycling Collecti	Throw it away (trash)
6	A3	5	229	113	67	57	70	92
7		4	60	105	78	57	85	78
8		3	36	81	89	82	122	58
9		2	12	33	66	63	50	58
10		1	15	21	51	91	21	65
11		Total	352	353	351	350	348	351
12	Q4	If you had to pay to recycle your electronic waste, how much would you be willing to pay?	$0	No more than $5	No more than $10	No more than $15	No more than $20	Total
13	A4	Response	121	187	73	18	0	399
14		If you had to spend time and effort to SAFELY recycle your electronic waste, how far (in miles) are you willing to travel?	0 miles	No more than 5 miles	No more than 10 miles	No more than 20 miles	More than 20 miles	Total
15	Q5	Response	32	146	129	40	6	353
16	A5	If recycling came at no direct cost to you, would you support a law that mandated electronic recycling and prohibited disposal (throw away) of electronic products in	Yes	No	Total			
17	Q6	Response	368	31	399			

7.4 Appendix D – WPI's E-Waste Recycling Drive's Collection Data

Not Considered E-Waste		Considered E-Waste	
Broiler Oven	1	Radios	3
Bread Maker	1	Record Players	3
Air Compressor	1	Stereo	4
Vacuum	2	Keyboards	4
Cameras	3	Scanners	4
Coffee Makers	3	CD players	4
Humidifier	3	DVD players	7
Microwave	4	Laptops	10
Telephones	4	VCR	13
Lamps	4	Printers	14
Thermostats	5	Monitors	19
Cell Phones	14	CPUs	44
Amps	18	TV	67
Batteries	100	Total	196
Total	163		

7.5 Appendix E - Interview Questions:

Interview with Senator Eldridge's Office: Kelsey Smithwood

- When do you envision the public hearing take place?
- How long will we know in advance to prepare?
- Would you like us to register as 3 independent citizens or present together?
    - How long will we each have to speak?
- How large is the crowd/who usually attends?
- What type of information do you think would be most influential?
- Should we be concerned with repeating topics of other presenters?
- What types of people attended?
- What seemed to be most influential?
- Is there anything that backfired or did not work?
- What topics were talked about most?
- Who were most of the presenters

Interview with Elizabeth Saunders & Lynne Pledger of Clean Water Action

Regarding Bill History

- Did you use other states as models for recycling E-waste in order to frame the bill?
    - If not, what other methods did you use to help you?
- What caused the Bill S352 to die in the Senate Ways & Means Committee in November 2011?
- Were there any key changes between Bill S352 and Bill S2078?
- In July 2012, what caused the Senate Ways and Means to propose an amendment to Bill S2078?
- Why hasn't the House Committee on Ways and Means taken action regarding Bill S2380?
- What stage is the new draft of S2380 currently in and what are the changes?

Regarding How the Bill Will Work

As we read it, sometimes retailers are financially responsible for their sales, while other times the manufacturers are responsible.

- What is the difference between a Retailer and a Manufacturer within the context of the Bill?
    - Who does the financial burden fall on in the case of a company like Best Buy?
    - Who does it fall on in the case of an independent small business?

Finally, we noticed a large change in the Collector-Processor-Producer triangle from the first bill draft to the e-Steward recycler regulations in the latest draft.

- What is the new pathway of E-Waste from consumer to processor?
- What caused you to change make this change?

7.6 Appendix F – E-Waste Team Outreach Poster's Education Section

Education:

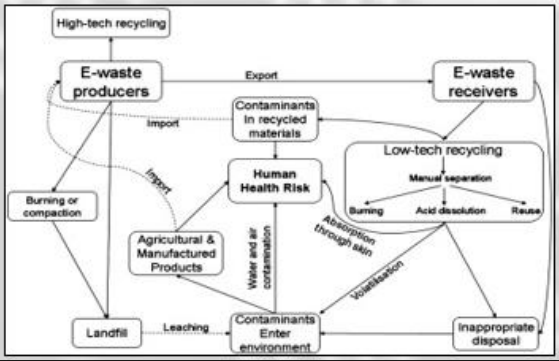
What is E-Waste & How is it Recycled?

Printers

Computers

TVs/Monitors

Paths of E-Waste after disposal:



Low-Tech Recycling

Burned in Incinerators – Huge health effects

Thrown in a Landfill – Lose precious resources

Exported to 3rd World Countries – Either or both

Toxic chemicals found in E-Waste:

Chemical	Use	Health Hazard
Beryllium	Springs, relays, connectors, motherboards	Lung cancer, acute and chronic beryllium disease
Cadmium	Laptops and computer batteries	Kidney and bone damage, heart disease, hypertension, lung cancer
Chromium Hexavalent	Metal housings	Skin reactions, cancer, kidney and liver damage
Lead	Printed circuit boards, cathode rays	Intellectual impairment in children, nervous, blood, and reproductive system damage in adults
Mercury	Lighting devices for flat screens, computer batteries	Central nervous system damage, kidney damage, heart disease
Brominated Flame Retardants	Circuit boards, plastic castings, mobile phones	Brain and skeletal development, permanent memory loss, delayed puberty

High-Tech Recycling: The Ideal Recycling Process

Collection

- Organizing E-Waste into appropriate groups for convenient recycling
- Adequate collection time

Transportation

- Secure packaging to ensure to safe travel of E-Waste from collection site to processing facility

Processing

- Safely disassembly of E-Waste into raw commodities
- Refurbish any reusable components of E-Waste
- Safely Removal of harmful containments
- Conducted by a certified recycler

Policy:

Internationally & in the U.S.

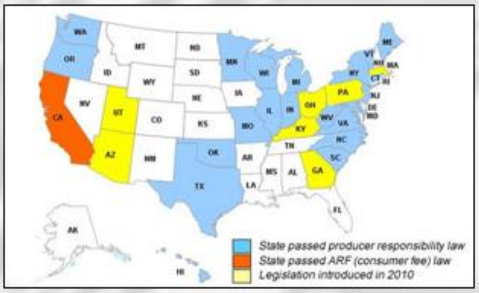
The EU vs. The US

Extended Producer Responsibility: a policy that requires manufacturers to accept responsibility for all stages in a product's lifecycle, including "end-of-life" management when people discard it. EPR policies generally require manufacturers to fund the collection, recycling, or safe disposal of discarded electronic products.

Across the Nation

Washington
- Extended Producer Responsibility
- Manufacturer pays all recycling fees

California
- Advance Recovery Fee
- Consumers pay fee at the time of sale



Maine
- Modified Producer Responsibility
- Consumer – E-Waste to collection site
- Municipality - storage and preparation for shipment
- Manufacturer - recycling

New York
- Extended Producer Responsibility
- Manufacturer pays all recycling fees
- E-Waste is a banned solid waste

E-Waste in Massachusetts

Types of waste banned in Mass:

Type of Waste	Examples
Cathode Ray Tubes	bulky-style televisions, computer monitors, oscilloscopes
Clean Gypsum Wallboard	un-painted drywall
Glass Containers	glass bottles, Pyrex cookware, windows
Lead Batteries	Lead-acid batteries used in motor-vehicles
Leaves	deciduous and coniferous leaves
Metal	building materials, industrial equipment, vehicles
Metal Containers	aluminum, steel or bi-metal beverage and food containers
Recyclable Paper	all paper and corrugated cardboard
Single Polymer Plastics	all narrow-neck plastic containers, labeled 1-6
Tires	continuous or pneumatic rubber from motor vehicles
White Goods	refrigerators, dishwashers, dryers, ovens, and water heater
Wood/Yard Waste	treated and untreated wood, seasonal depositions

These are the bills out now:

E-Waste Issues
March 26, 2013, 10:00 AM, Hearing Room B1
COMMITTEE ON ENVIRONMENT, NATURAL RESOURCES, & AGRICULTURE

March 21, 2013 E-Waste Bills

Bill Number	Sponsor/Title	
H729	Rep. Jones	An Act establishing the commission on extended producer responsibility
H741	Rep. Kocot	An Act to create a framework to re-allocate responsibility for discarded products
H803	Rep. Smizik	An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products
S346	Sen. Chandler	An Act to create a framework to re-allocate responsibility for discarded products
S357	Sen. Eldridge	An Act to require producer responsibility for collection, reuse and recycling of discarded electronic products.
S386	Sen. Pacheco	An Act relative to information technology producer responsibility

Our Project:

Abstract

Twenty-six states have laws that require the recycling of electronic products, or E-Waste. Most of these states use a proven model of Extended Producer Responsibility (EPR), whereby the producer of E-Waste is held financially responsible for recycling the products they create. In Massachusetts, E-Waste is the fastest growing category of waste in the state, yet no laws mandate creation of a statewide E-waste recycling program. We are working under the guidance of Senator Jamie Eldridge's office to facilitate passage of strong E-waste recycling legislation. Our approach to achievement of this goal includes: educating the public about E-Waste recycling and advocating legislators to sponsor comprehensive and effective legislation. We identified the essential features of effective recycling programs and evaluated the provisions of

E-Waste legislation at the international, federal and state levels. We created a web site to educate the public and facilitate petitioning legislators in support of E-Waste bills, hosted events for recycling in Worcester and worked with colleges in Massachusetts to increase student awareness of the need for e-waste recycling programs. Finally, we testified at a public hearing before the Environmental Committee and attended an informal caucus of legislatures. Our findings indicate there is strong support for progressive E-Waste legislation in Massachusetts.

Methodology

Testimony before the Joint Committee on Environment, Agriculture and Natural Resources at the Statehouse

Help & surveying at the WPI Green Team E-Cycling event

Education at the EcoTarium Earth Day Celebration

EcoTarium
science.nature.explore.connect.

Presentations at colleges with many Massachusetts residents

UMass Dartmouth 96%

Emerson College 77%

Worcester State 97%

UMass Boston 95%

Our website for background, bill status, survey, and advocacy

http://sites.google.com/site/massewaste

7.7 Appendix G – Formal Letter to Committee on Environment

March 26, 2013

The Honorable Marc Pacheco, Senate Chair
Joint Committee on Environment, Natural Resources and Agriculture
State House Room 312B
Boston, MA 02133

The Honorable Anne Gobi, House Chair
Joint Committee on Environment, Natural Resources and Agriculture
State House Room 473F
Boston, MA 02133

Re: Electronic Waste Legislation in Massachusetts

Dear Senator Marc Pacheco and Representative Anne Gobi,

We are writing to you with regards to electronic waste recycling legislation for the state of Massachusetts. There are five key points we wish you to consider:

1. **Infrastructure:** specifically a way to track parties involved in recycling as well as an Advisory Committee of legislators and experts to adapt the program as it develops
2. **Education:** a multitude of ways for the public to learn of the program, especially in the early stages, which requires a combined effort from manufacturers and government [5]
3. **Enforcement:** a system to catch fraudulent activity and the legal weight for the Department of Environmental Protection to take action against infractions [6]
4. **Disposal Ban:** a provision in legislation that makes e-waste a Banned Solid Waste, making it illegal to throw e-waste in the trash [7]
5. **Joint and Several Liability:** a provision that will cover products that might have multiple producers manufacturing parts [8]

Based on our research, we strongly believe these are the components for robust e-waste legislation.

We hope you view us as not just three college students, but as representatives of the technology generation. We represent those who will not only produce more electronic waste than ever before, but also the ones to deal with the repercussions if an effective recycling program is not implemented soon.

Thank you again for your time. We hope you consider our recommendations.

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