

# Electronics EPR: A Case Study of State Programs in the United States

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**DRAFT**

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*Prepared by the Product Stewardship Institute, Inc.*

## **The Product Stewardship Institute**

The Product Stewardship Institute (PSI) is a national, membership-based nonprofit committed to reducing the health, safety, and environmental impacts of consumer products across their lifecycle with a strong focus on sustainable end-of-life management. Headquartered in Boston, Mass., we take a unique product stewardship approach to solving waste management problems by encouraging product design changes and mediating stakeholder dialogues. With 47 state environmental agency members, along with hundreds of local government members from coast-to-coast, and 95 corporate, business, academic, non-U.S. government, and organizational partners, we work to design, implement, evaluate, strengthen, and promote both legislative and voluntary product stewardship initiatives across North America.

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## I. INTRODUCTION

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In the U.S., the term product stewardship refers to either a voluntary or regulatory (policy-based) approach to minimizing the health, safety, environmental, and social impacts of a product and its packaging throughout the product lifecycle. On the other hand, Extended Producer Responsibility (EPR) refers to a mandatory type of product stewardship in which manufacturers take primary financial and managerial responsibility for the safe and environmentally sound management of their products post-consumer use. EPR policy features two elements: (1) shifting financial and managerial responsibility upstream, to the producer, and away from the public sector, while maintaining some government oversight; and (2) providing incentives to producers to incorporate environmental considerations into the design of their products and packaging.<sup>1</sup> This definition is consistent, but not precisely aligned, with the definition of EPR used by the Organisation for Economic Co-operation and Development (OECD).

Over the past 15 years, EPR systems in the U.S. have grown rapidly at the state level and, to a lesser extent, at the local level. Little traction has been gained at the national level, however. As of June 1, 2014, 81 EPR laws were active in 32 states, collectively covering 10 product categories (see Table 1).<sup>2</sup> State governments enacted all but three of these 81 laws, while municipal governments passed the remaining three.<sup>3</sup> The number of U.S. laws has grown dramatically in the last decade, as evidenced by the fact that fewer than 10 EPR laws were in place at the end of 2001.

Twenty-five states have passed legislation related to scrap electronics (e-scrap) recycling; however, there are differing opinions about whether all 25 can be considered EPR or product stewardship. The U.S. definition of product stewardship most closely aligns with the OECD's definition of EPR and, therefore, has guided the selection of state programs profiled in this report. Of the 25 laws in this report, 23 are considered EPR per the U.S. definition, and two (California and Utah) are considered product stewardship.

Most of the e-scrap laws in the U.S. drew concepts from a process convened by the U.S. Environmental Protection Agency (EPA) from 2001 to 2003, in which PSI actively participated. Known as the National Electronics Product Stewardship Initiative (NEPSI), the process consisted of a series of national stakeholder meetings focused on developing a product stewardship system to increase electronics recycling. Ultimately, these meetings disbanded without an agreement; however, they did help shape state electronics EPR laws.

A chart providing details on each state program is provided in Appendix B.

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<sup>1</sup> "Product Stewardship and Extended Producer Responsibility: Definitions and Principles," developed by Product Stewardship Institute, Product Policy Institute, and California Product Stewardship Council, has been endorsed by more than 60 organizations. See <http://www.productstewardship.us/?page=Definitions>. In the U.S., advanced recycling fees are considered product stewardship policies but not EPR policies because they are neither financed nor managed by producers.

<sup>2</sup> The 81 laws do not include the 11 states with bottle bills.

<sup>3</sup> In 2012 and 2013, two municipalities – Alameda County (California) and King County (Washington) – implemented EPR programs for unwanted pharmaceuticals. In 2013, New York City enacted Local Law 69 requiring appliance manufacturers to assume financial responsibility for managing products containing refrigerants.

**Table 1: U.S. EPR Laws by Type of Product**

<b>PRODUCT TYPE</b>	<b>NUMBER OF EPR LAWS</b>
Electronics	<b>23*</b>
Mercury Auto Switches	<b>15</b>
Mercury Thermostats	<b>11</b>
Batteries	<b>10</b>
Paint	<b>7</b>
Mattresses	<b>3</b>
Mercury-added Lamps	<b>3</b>
Pharmaceuticals	<b>2**</b>
Carpet	<b>1</b>
Cell Phones	<b>1</b>
Pesticide Containers	<b>1</b>
Products Containing Hazardous Substances	<b>1***</b>
EPR Framework	<b>1</b>
Refrigerant (does not include the appliance containing refrigerant)	<b>1**</b>

\* This includes the 23 states laws that meet the US definition of EPR; it excludes California and Utah, which meet the US definition of product stewardship.

\*\* Municipal laws

\*\*\* California’s Green Chemistry Act authorizes the Department of Toxic Substances Control to require manufacturer take-back of products containing hazardous substances for which a viable commercial alternative does not exist.

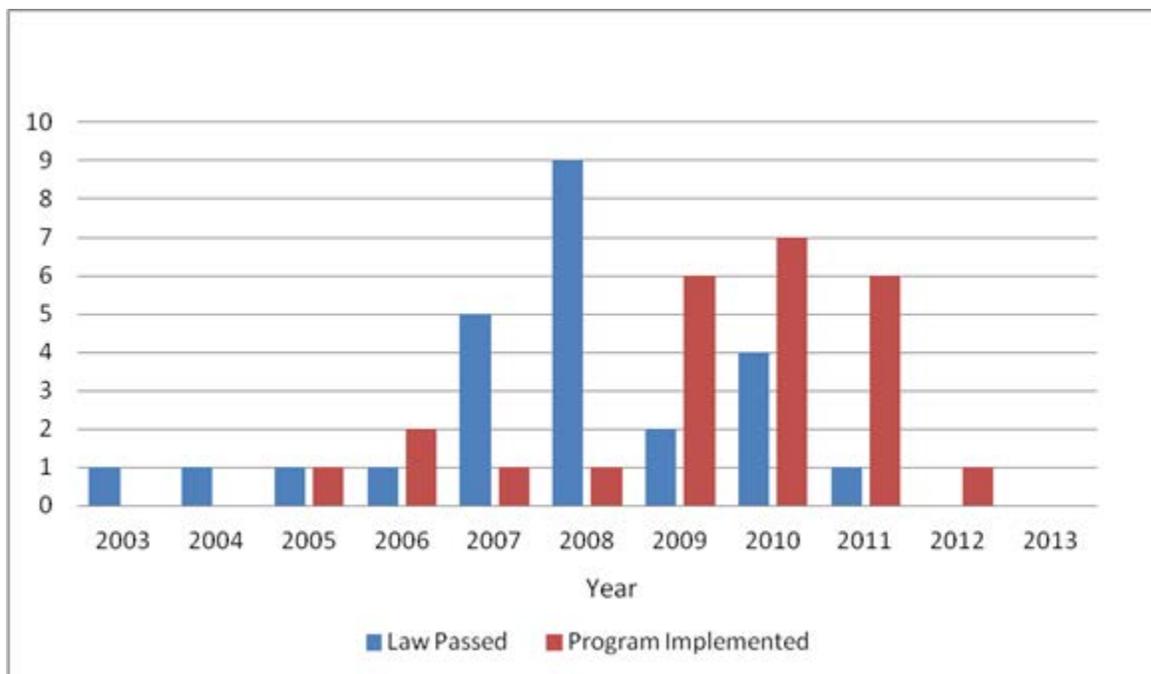
Since 2003, 25 states have enacted product stewardship legislation for consumer electronics. Each state has developed its own program to accommodate different operational and statutory factors. However, these laws achieve largely the same objectives as other EPR systems in the U.S.:

- **Reduce government costs** - Alleviate the cost burden of electronics scrap management from municipalities and taxpayers.
- **Divert material from disposal facilities** - Divert material out of the general solid waste stream, thereby increasing recycling.
- **Create jobs** - Provide a steady funding stream and work flow for recycling companies and supports the jobs they create.

- **Create incentive for environmentally preferable products** - Seek to internalize management costs for manufacturers, encouraging design of products that are less toxic, more recyclable, and comprised of recycled materials.

Figure 1 shows the year in which each of the 23 e-scrap EPR laws and two e-scrap product stewardship laws were passed, as well as the year each law was implemented. The vast majority (20 out of 25) were passed between 2007 and 2010. Because of a lag between law enactment and program implementation, most programs (19 of 25) were implemented between 2009 and 2011. The most recent program was implemented in 2012. While some programs are collecting a wealth of valuable data, most of them have been in place for only a few years, making it difficult to evaluate their collective efficacy. As programs become more mature, more data will be available, and therefore a more comprehensive evaluation will be possible.

**Figure 1: Number of e-Scrap Laws Passed and Implemented by Year (2003-2013)**



In contrast, action on e-scrap issues at the federal level has been limited. From 2006-2008, the Congressional House Energy and Environment Committee met with multiple stakeholder groups to develop national legislation for electronics stewardship, and a bi-partisan Congressional E-Waste Working Group developed a Federal E-Recycling Concept Proposal. Congress has also twice considered legislation that would ban the export of non-working electronic scrap to developing nations<sup>4</sup>—policy designed to address the negative health and environmental impacts of irresponsible management and limit the trade of counterfeit electronic components. The latest bills are currently in the House and Senate environment committees.

<sup>4</sup> “Developing nations” is defined as any country outside the OECD, European Union, or Lichtenstein. Full text and bill summary available at <https://www.govtrack.us/congress/bills/113/hr2791>.

## II. LEGAL ASPECTS

Electronics EPR laws in the U.S. represent a patchwork of programs that differ by scope of products covered, performance targets, and other important factors. However, both EPR and product stewardship programs typically incorporate a combination of the 14 program elements listed in Table 2.

**Table 2: Legal Aspects Comprising U.S. Electronics EPR Laws**

Legal Aspect	Brief Definition
<b>Product scope</b>	What electronic devices are covered by the EPR law
<b>Covered entity</b>	Who is entitled to recycling
<b>Program financing</b>	Method of defining manufacturer’s financial obligation
<b>Performance goals</b>	Manufacturer recycling goals
<b>Convenience standards</b>	What level of collection convenience must be provided by manufacturer/manufacturer program
<b>Stewardship plan</b>	Contents of a stewardship plan submitted to regulatory authority for approval
<b>Municipal collection requirements</b>	Role of municipalities in providing electronics collection
<b>Disposal bans</b>	Restrictions on managing electronics in landfills or waste-to-energy facilities
<b>Outreach and education requirements</b>	EPR program information to be provided by manufacturers, retailers, recyclers, and/or state and local governments
<b>Reporting requirements</b>	Reporting frequency and content required from manufacturers, recyclers, collectors and governments
<b>Penalties for violation</b>	Penalties for noncompliance with EPR law
<b>Procurement</b>	Requirements for government agencies to purchase electronic devices covered in the EPR law that meet specific environmental standards
<b>Environmental statements</b>	Disclosure of product compliance with the EU RoHS Directive
<b>Recycler certification</b>	Requirements for third-party certification (e.g., R2, eStewards)

**Product scope** identifies the “covered electronic devices” (CEDs) that can be collected through manufacturer programs and counted toward their performance goals. Manufacturers of CEDs are responsible for registering with the state oversight agency and to accept these CEDs for recycling. Product scope varies greatly between states: the states with the greatest coverage (New York and Illinois) cover 18 equipment types, whereas the state with the least coverage (Missouri) only includes three equipment types. All 25 state programs include laptops and monitors in this definition; two states exclude desktop computers, and three exclude televisions (TVs). Fourteen states also include computer peripherals, such as printers, keyboards, and mice; only five states include TV peripherals, such as digital versatile disc (DVD) players. The table in Appendix C provides more detail on the product scope included in the state laws.

PSI has organized the 25 programs into three categories based on the breadth of their product scope (see Table 3):

- **Limited Product Scope (9 states):** These programs only accept major products (TVs, computers, and monitors), or a subset of these products.
- **Average Product Scope (10 states):** These programs accept major products (TVs, computers, and monitors) as well as some computer or TV peripherals (e.g., printers, DVD players).
- **Comprehensive Product Scope (6 states):** These programs accept 10-18 equipment types. Some programs in this category employ significantly more thorough product scope than others. The most comprehensive produce scopes are in Illinois and New York.

**Table 3: Product Scope by State**

	Limited Product Scope	Average Product Scope	Comprehensive Product Scope <sup>5</sup>
<b>Number of States (Total: 25)</b>	9	10	6
<b>States</b>	California, Maryland, Missouri, New Jersey, Oklahoma, Rhode Island, Texas, Virginia, West Virginia	Connecticut, Hawaii, Maine, Michigan, North Carolina, Oregon, Pennsylvania, South Carolina, Vermont, Washington,	Illinois, Indiana, Minnesota, Utah, Wisconsin, New York

**Covered entity** defines the consumer groups that can bring back their CEDs under the state’s EPR program. All state programs include households; 14 of them allow small businesses and non-profits or charities to bring back their CEDs; and 10 include CEDs from schools. New York and Hawaii have the most comprehensive covered entities of all of the programs. Hawaii covers virtually all generators, and in New York all households, small businesses, small non-profits, schools, and government entities to free and convenient e-scrap collection, and manufacturers can use CEDs generated by any entity in the state (including businesses) to meet their performance goals.

PSI has organized the 25 programs into three categories based on the breadth of their covered entities (see Table 4):

- **Limited Covered Entities (16 states):** These programs accept CEDs from households only, or from households and one other group.
- **Average Covered Entities (4 states):** These programs accept CEDs from 3-4 consumer groups.
- **Comprehensive Covered Entities (5 states):** These programs accept CEDs from 5-6 consumer groups.

<sup>5</sup> The Indiana, Minnesota, and Wisconsin programs are unique in that they define a narrower scope of CEDs, but performance goals can be met by recycling a more expansive list of electronics devices.

**Table 4: Covered Entities by State**

	Limited Covered Entities	Average Covered Entities	Comprehensive Covered Entities
<b>Number of States (Total: 25)</b>	16	4	5
<b>States</b>	Connecticut , Illinois, Maryland, Michigan, Minnesota, Missouri, New Jersey, North Carolina, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Texas, Utah, Virginia, Wisconsin	Indiana, Maine, Oregon, Vermont	California, Hawaii, New York, Washington, West Virginia

**Program financing** defines the approach used to assign manufacturer financial obligations in the 23 state programs that place end-of-life management responsibility on the manufacturer.<sup>6</sup> Twenty of the 23 programs assess a manufacturer registration fee and, in most cases, those fees are used to cover the state’s costs for oversight functions. In addition to registration fees, manufacturers typically assume financial responsibility for collecting and recycling electronics. The financial obligation is determined using one of the following methods:

- **Market Share:** Manufacturers are responsible for the costs of collecting and recycling an amount of electronic scrap that is proportionate to their share of estimated or actual state sales of CEDs.
- **Market Share – TV’s Only:** Television manufacturers have a market share obligation, but there is no specific financial obligation for information technology (IT) product manufacturers.
- **Hybrid Market/Return Share:** Cost of collecting and recycling is assigned to manufacturers based on a mix of market share and return share. Typically, television manufacturer obligations are defined by market share, while IT manufacturer obligations are return share.
- **Financing Obligation Mechanism Not Specified:** Manufacturers are obligated to develop and implement e-scrap collection plans/programs with no definition of how the financing should be structured.

A state-by-state breakdown of these financing obligations is summarized in Table 5.

<sup>6</sup> This section does not include California or Utah, since the California ARF system does not assign financial obligations to the manufacturer and the Utah program is voluntary.

**Table 5: Financial Obligations Implemented by U.S. States with EPR Programs**

Type	States
Market Share	Indiana, Illinois, Minnesota, New York, Pennsylvania, South Carolina, Vermont, Wisconsin
Market Share – TVs Only	Hawaii, North Carolina, Texas
Hybrid	Connecticut, Maine, New Jersey, Oregon, Rhode Island, Washington
Funding Obligation Mechanism Not Specified	Maryland, Michigan, Missouri, Oklahoma, Virginia, West Virginia

**Performance goals** define the quantity of material that must be collected annually, either on a per-capita basis or as a percentage of prior year’s sales. Thirteen of the 25 state laws either set goals in statute or confer authority for setting collection performance goals to the state entity responsible for overseeing the law’s implementation.<sup>7</sup> Because all material collected must be recycled or refurbished for reuse, collection goals are synonymous to recycling goals.

**Convenience standards** define the extent of the collection network required to ensure consumer convenience. Most state legislation includes some language addressing consumer convenience, but eight of the 25 states analyzed currently prescribe significant minimum convenience standards (e.g., at least one per county or municipality).<sup>8</sup> Some of the other states simply mandate that collection of unwanted electronic devices should be “convenient” to consumers, without defining “convenient.” The more prescriptive states require that manufacturers have physical collection locations (in addition to mail-back options) based on population density or distance to collection services. For example, Washington and Oregon both require at least one collection site or service in every county, as well as one collection site in every city with a population of 10,000 or more. New Jersey requires each county to have at least one collection site.

**Stewardship plan requirements** describe the elements that a manufacturer must include in the plan submitted to the state environmental agency for approval. Eleven states currently require these plans.<sup>9</sup>

**Disposal bans** prohibit the disposal of electronic devices, either in waste to energy facilities and landfills, or in landfills alone. These bans support the programs by redirecting materials to be collected for recycling. Sixteen of the 25 states have some type of disposal ban on electronics.<sup>10</sup>

<sup>7</sup> The thirteen states are Hawaii (TVs only), Illinois, Indiana, Minnesota, North Carolina (TVs only), New Jersey, New York, Oregon, Pennsylvania, Rhode Island, South Carolina, Vermont, and Wisconsin.

<sup>8</sup> The eight states are Connecticut, Maine, New Jersey, New York, Oregon, Vermont, Washington, and Rhode Island.

<sup>9</sup> The 11 states are Hawaii, Missouri, New Jersey, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, Texas, Vermont, and Washington.

<sup>10</sup> *States with Landfill Bans*, ERCC, <http://www.ecycleclearinghouse.org/Content.aspx?pageid=101>

**Municipal collection requirements** describe the role of municipal governments in providing electronics collection sites and funding collection. Only two states—Connecticut and Maine—assign municipalities responsibility for ensuring convenient collection locations for their residents. In those states, municipally designated collection sites arrange for material pick-up by state-approved consolidators or recyclers. Those entities then obtain payment from manufacturers to cover the cost of transportation, consolidation, and recycling.

**Outreach and education requirements** describe the roles and responsibilities of various entities (e.g., manufacturers, municipalities, or retailers) for educating consumers about the EPR law and opportunities for recycling CEDs.

**Reporting requirements** describe the type of information that must be tracked, as well as the frequency with which manufacturers, recyclers, and the state agency overseeing program implementation conduct their reports. All states require their implementing agency to report on the quantity of CEDs recycled; however, reporting requirements for manufacturers and recyclers vary widely.

**Penalties** are the state enforcement penalties imposed on manufacturers that do not register with the state or that fail to meet financial obligations or collection requirements. Such penalties may be imposed on retailers that sell a non-registered manufacturer's CEDs or on manufacturers that have not registered with the state. Twenty-one of the 24 state laws include penalty provisions.

**Procurement** requirements direct state agencies to purchase electronic devices containing recycled materials or products designed with environmental attributes that consider the full product lifecycle. Two states—Illinois and Rhode Island—include this element in their EPR laws, requiring procurement of electronic products that meet or exceed the Electronic Product Environmental Assessment Tool (EPEAT) bronze level.<sup>11</sup> Maine requires that state agencies give purchasing preference to electronic devices that incorporate design for environment (DfE) elements. North Carolina requires state and local agencies to purchase TVs from manufacturers who met their performance requirement in the previous year.

**Environmental statements** can help increase demand for environmentally preferable products. Seven of the 24 state programs require that manufacturers' products be compliant with the EU Directive on the Restriction of Hazardous Substances (RoHS), or that the manufacturers notify the state if any of their products exceed these levels.

**Recycler certification** requirements can ensure that recyclers responsibly handle scrap electronics. Currently, only four states<sup>12</sup> require that recyclers be certified by third-party certification organizations (e-Stewards<sup>13</sup> or R2<sup>14</sup>), as most state laws were passed prior to the development of these certification standards.

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<sup>11</sup> See [www.epeat.net](http://www.epeat.net) for further information about this assessment tool.

<sup>12</sup> The four states are Pennsylvania, Rhode Island, South Carolina, and Vermont.

<sup>13</sup> The e-Stewards certification program was created by the Basel Action Network at the request of recycling industry leaders. It is an internationally compliant certification program that addresses a comprehensive suite of e-recycling best practices. For more information: <http://www.e-stewards.org/certification-overview/>.

Additional statutory elements related to governance are described in the next section. The impact of these program elements on program performance is evaluated in Section IV.

### III. GOVERNANCE

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#### *Program Oversight and Data Reporting*

In the U.S., state agencies or departments responsible for environmental quality or public health oversee e-scrap stewardship programs, and in most cases, manufacturer registration fees or penalties for noncompliance cover costs for program oversight. Government roles vary widely across the different states, however. Twenty of the programs require manufacturers of CEDs to register with the state as a prerequisite to selling their products. All states forbid retailers from selling CEDs from manufacturers that are not registered or otherwise out of compliance with the program. These conditions help minimize the problem of “free riders”—manufacturers that eschew the mandatory program fees and other requirements while profiting unfairly at the expense of their competitors—by ensuring that all manufacturers are subject to the law’s terms.

Program transparency hinges on the availability of material flow data across the many different links in the electronic scrap collection and recycling chain, as well as the reporting of these data to state and other stakeholders. For example, in a fully transparent program, each consolidator<sup>15</sup> would be required to identify and report the weight of material received from each collector, and then identify each recycler and weight of material the recycler receives from the consolidator. Similar information would be required from each recycler, along with the weight of each material sent off-site for final recycling or disposal. Complete transparency would also require manufacturers to disclose the programs/collection sites they support, amounts recycled, and entities engaged.

While nearly all EPR programs require manufacturers to register and report sales and collection data, only about half of the programs in the U.S. require other entities involved to register and report. Twelve state programs perform data cross-checks between different stakeholders.<sup>16</sup> Additionally, only aggregated data, if any, are typically reported (e.g., pounds of material recycled). Thus, many state programs do not provide meaningful transparency.

Furthermore, half of the U.S. programs do not require detailed audits of collection and recycling data, and only 60 percent of the state programs regularly conduct inspections and/or site visits to in-state

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<sup>14</sup> The R2 Standard is a program of R2 Solutions, and was developed over a three-year multi-stakeholder process. It includes requirements for environmental and public health, worker health and safety, data security, and maintaining a consistent chain of custody throughout the recycling process. For more information: <http://www.r2solutions.org/>.

<sup>15</sup> Some state programs distinguish between collectors, who are responsible for collecting CEDs, and consolidators, who may receive CEDs from collectors and are responsible for categorizing or consolidating CEDs prior to transporting the devices to a recycling facility.

<sup>16</sup> Electronics Recycling Coordination Clearinghouse (ERCC) “Summary of results from 2013 pre-ERCC workshop state survey,” 2013.

collection and recycling facilities.<sup>17</sup> Those states that do not conduct program audits and data cross-checks have higher uncertainty in their reported collection numbers.

### *Program Management*

All electronics EPR programs in the U.S. allow producers to meet their legal requirements either individually or collectively. While several manufacturers choose to run their own programs, many work through producer responsibility organizations (PROs) to execute their obligations under the law. Governance and legal structure vary by organization.

In seven states, manufacturers are required to submit a stewardship plan to the state environmental agency for review and approval. Stewardship plans generally include how the manufacturer or group of manufacturers plans to meet the performance goals, consumer convenience standards, and/or other requirements. They may also include public education/outreach plans and other program elements.

Four states—Vermont, Oregon, Washington, and Rhode Island—uniquely offer manufacturers a central collection and recycling program. In these states, a contractor or designated quasi-governmental entity serves as the PRO, managing the recycling infrastructure and in some cases collecting fees from manufacturers to cover the costs. Additionally, manufacturers can opt-out of the state program under certain circumstances, such as in cases where their existing or proposed collection and recycling programs meet the same standards as the state program.

In Maine and Connecticut, the state plays an active role in identifying and approving consolidators and recyclers. Municipal collectors make agreements with approved service providers, who then bill the manufacturers for the transportation, consolidation, and recycling services at a state-approved rate.

## **IV. COVERAGE AND QUALITY OF WASTE COLLECTION & TREATMENT**

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### *Equipment Types Collected*

Many states maintain data on the types of electronic equipment collected in their programs. State programs that calculate manufacturer obligations based on return share need to delineate equipment weight by brand, and often by type. Since the programs analyzed primarily target household materials, the stream is typically made up of a substantial majority of TVs and monitors, with a much smaller proportion of the more valuable IT equipment. The National Center for Electronics Recycling (NCER), in partnership with the Connecticut Department of Energy and Environmental Protection (CT DEEP), conducted a survey on material collected through Connecticut's statewide electronics recycling program and found that TVs and computer monitors account for more than 90 percent of the weight of materials collected (see Figure 6). This mix is typical of materials returned through state electronics programs.

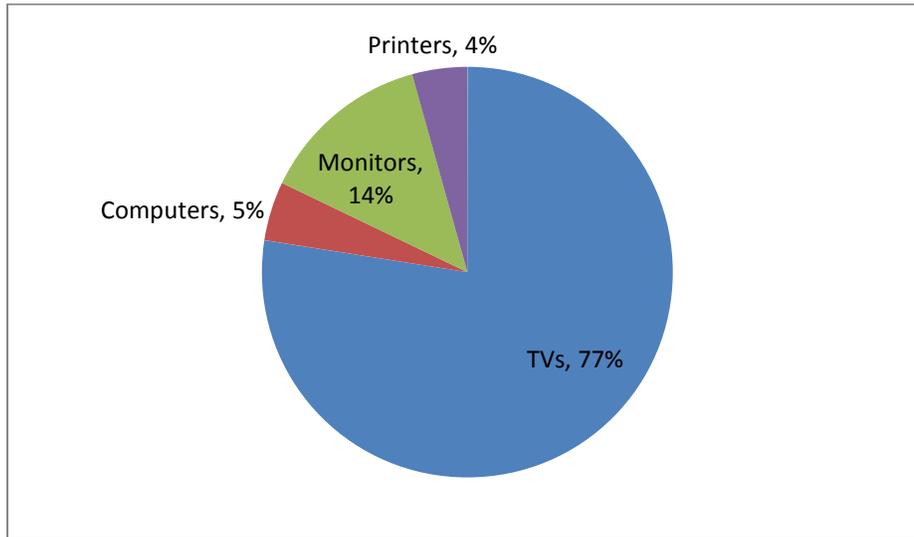
**Figure 2** shows the weight-based breakdown of equipment type by percentage of Connecticut's collected electronic scrap.<sup>18</sup>

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<sup>17</sup> *Ibid.*

<sup>18</sup> Source: National Center for Electronics Recycling, <http://www.electronicrecycling.org/public/ContentPage.aspx?r=s&terms=connecticut%20deep&PageID=156&ParentID=2> Accessed March 20, 2014.

**Figure 2: Composition of Scrap Electronics Collected by Connecticut, 2012**



### **Recovery Rates for EPR Programs**

While state EPR programs are successful in collecting significant amounts of electronic scrap, it is difficult to calculate a specific recovery rate, which relies on both the amount collected and the amount *available* for collection, which is difficult to ascertain. The amount available for collection depends on many variables that are difficult to predict, such as the length of storage, whether the equipment is given to another user, and how often it is replaced. Recent studies have attempted to quantify how much e-scrap is still in people’s homes, but there is no way to predict when that equipment will be removed for end-of-life management. Therefore, there are no reliable traditional recovery rate estimates. Instead, as noted above, most programs track pounds collected on a per-capita basis to evaluate program performance.

### **Electronics Recycling Collection Methods & Reach**

Sixty-five percent of the U.S. population resides in the 25 states with e-scrap product stewardship laws. Most electronics recycling programs in the states studied use some combination of the following collection methods:

- Return to Retail Store
- Drop-off Site (municipal or other)
- Collection Event
- Mail Back

Some states specify which types of collection are acceptable in manufacturer programs, and a few require a minimum number of fixed collection sites. These collections can be supplemented with, but not replaced by, events, return to retail, or mail-back. Other states allow manufacturers a broader array of collection options.

## Sorting & Recycling Systems

Since most of the electronics equipment collected in U.S. product stewardship programs comes from residences and not businesses, it has little reuse value. Typically, this material is brought to a consolidator or recycler for sorting, disassembly, and processing, with the various commodities and components being sold to end-use markets or downstream processors. To verify how materials are handled, some states require collectors, consolidators, and recyclers to report their markets and downstream vendors.

During disassembly, potentially hazardous components, (e.g., CRT tubes, mercury containing lights, and batteries) are removed and sent for recycling or proper disposal. The remaining materials are processed for sale to plastics and metals markets, while circuit boards (whole or shredded) are sold to smelters capable of separating the valuable metals they contain. A recent report concluded that e-scrap recyclers in the U.S. generate up to three percent residue and a small amount of potentially hazardous materials, while the vast majority of outputs go on to commodity markets.<sup>19</sup>

While no hard data exist, most stakeholders report that the environmental performance of the e-scrap recycling sector has improved in recent years. Four states have specified that manufacturers use recyclers certified through one of the two U.S. systems (R2 or eStewards); however, most manufacturers contract with certified recyclers to meet their obligations in all the states studied.

## E-Scrap Exports

The export of e-scrap, particularly to under-regulated developing countries where it is handled in ways that can harm human health and the environment, has historically been a contentious issue in the U.S. Unfortunately, state e-waste programs are unable to regulate export, as such regulation would open them to a legal challenge under the Commerce Clause of the U.S. Constitution, which states that only the U.S. Congress can regulate commerce between countries; it is illegal for states to regulate exports. The states' inability to regulate e-scrap exports has been the driver for proposed national legislation. The U.S. Congress introduced the Responsible Electronics Recycling Act of 2013 that would make it illegal to send scrap electronics from the U.S. to developing nations. To date, this legislation is still pending.

The two e-scrap recycler certification programs, eStewards and R2, were developed in part in response to concern regarding the impact of irresponsible export. While the certification programs set different requirements on exports (the eStewards program is more stringent in that regard), they both aim to provide greater certainty to generators that their materials will be handled safely and appropriately. Some state programs, and many manufacturers, rely on certified recyclers as a means to ensure safe material handling.

Determining the exact amount of e-scrap that is exported, and determining the amount of this e-scrap that originates from the states with EPR programs, is a challenging task. Several studies have attempted to estimate e-scrap exports; most notably, the U.S. International Trade Commission (USITC) issued a report on this subject in early 2013. The USITC report found that 7 percent of the sales from U.S. e-scrap recyclers in 2011 went to foreign markets, with Mexico, India, Hong Kong, China, and other Asia-Pacific countries representing the leading destinations. Seventy percent of those exports were refurbished,

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<sup>19</sup> *Used Electronic Products: An Examination of U.S. Exports*, US International Trade Commission, February 2013.

working units, while 30 percent were disassembled commodities.<sup>20</sup> While this report was criticized by some as underestimating exports,<sup>21</sup> it is the best data available to date. A report released later in 2013 found that 8.5 percent of certain types of e-scrap units were exported in 2010, which corresponds to 3 percent of e-scrap by weight.<sup>22</sup>

## V. PROGRAM PERFORMANCE

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While recycling rates for scrap electronics have been steadily increasing since 2000, only an estimated 29 percent of this stream was recycled as of 2012.<sup>23</sup> This section explores the relationship between key program elements and program performance, as measured by per-capita collection rates.

State product stewardship programs for electronics have been in operation for varying lengths of time. While the oldest program (California's ARF) has been in operation since 2005, the majority of the 25 programs were implemented in 2009 or later. Thus, long-term performance data are lacking, and many programs have not reached a level of maturity as seen in longer-operating programs. Additionally, some states have expanded their programs over time. For example, in 2012, Illinois significantly expanded the types of CEDs accepted by the program from 4 to 17, and in 2013 Texas began collecting televisions. Since televisions, especially older CRT-based units, comprise the majority of scrap electronics by weight (see Figure 2), this change in Texas's program is likely to cause a spike in the state's collection in the coming years.

Since annual generation of e-scrap is difficult to assess (given varying product life spans and people's tendency to store some materials), per-capita collection rates are typically used to track program performance. As described below, per-capita rates have some critical flaws, yet they remain the best benchmarking tool currently available. Figure 3 demonstrates the wide breadth of per-capita collection rates in the 25 programs analyzed.

### *Limitations of Using Weight-Based Collection Metrics to Evaluate Performance*

Although program success for electronics EPR is calculated in terms of weight, weight-based metrics can pose challenges if used to compare program performance across states. This is because state programs differ in terms of what types of devices are accepted and from whom. For example, New York's program, which collected 4 pounds per capita in 2012, ostensibly outperformed Connecticut's 3.2 pounds. However, New York's program accepts a broader scope of products and from more covered entities than Connecticut. There may, in fact, be more e-scrap recycled in Connecticut, but the state program data only includes the covered devices that are collected from covered entities.

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<sup>20</sup> *Used Electronic Products: An Examination of U.S. Exports*, US International Trade Commission, February 2013.

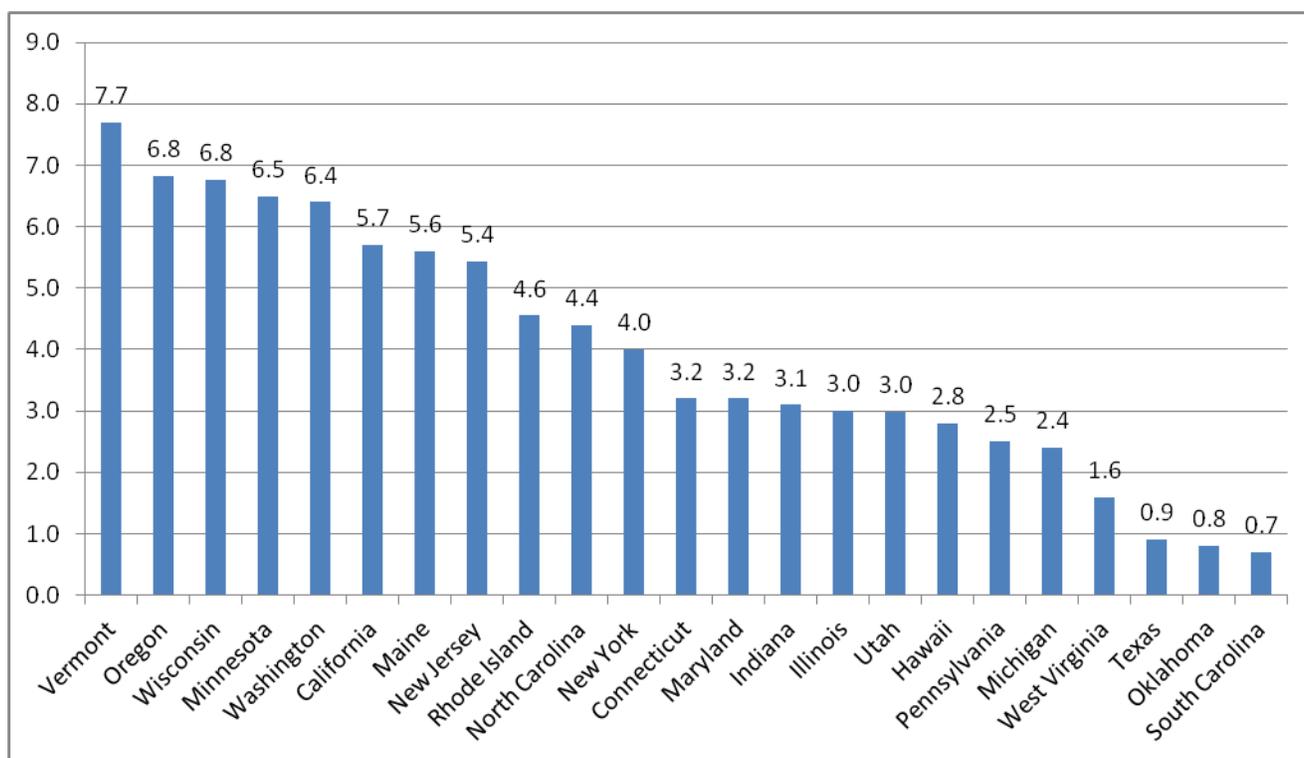
<sup>21</sup> <http://www.electronicstakeback.com/2013/03/13/statement-on-the-new-itc-report-on-exports-of-electronic-waste/>

<sup>22</sup> *Quantitative Characterization of Domestic and Transboundary Flows of Used Electronics*, MIT & NCER, December 2013

<sup>23</sup> U.S. EPA Office of Resource Conservation and Recovery, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States Tables and Figures for 2012, Feb. 2014*

Furthermore, the twin trends of lightweight product design and rapid product obsolescence mean that more, lighter products are entering the waste stream. So, while the total weight of all electronic devices collected throughout the U.S. should stabilize or fall at some point in the future, the number of accepted electronic devices available for collection can be expected to increase as consumer demand for electronics rises. Many programs will appear to be stagnant even though they will likely be accepting more CEDs than ever before. As products entering the waste stream will be lighter in weight, weight-based metrics will be a poor indicator of program growth, but may still be used to compare performance among different state programs. This is a factor that favors programs with strong convenience standards: a robust collection infrastructure will capture the available materials regardless of their weight. Nonetheless, the best available data on state e-scrap programs uses pounds per capita collected as a key performance metric, and therefore it is presented here.

**Figure 3: Pounds of Used Electronics Collected Per Capita in State Programs (2012)**



Sources: Electronics Recycling Coordination Clearinghouse<sup>24</sup> and information provided by the Maryland Department of the Environment, Texas Commission on Environmental Quality, and Indiana Department of Environmental Management.

### Variables Impacting Program Performance

Tables 6, 7, and 8 compare select state programs based on key policy elements and per-capita collection rates. Five high-performing states are presented in Table 6, four average-performing states are presented in Table 7, and four low-performing states are presented in Table 8. Together, they highlight the difference in policy choices between high-performing, average, and low-performing states.

<sup>24</sup> Available on the website, at: <http://www.ecycleclearinghouse.org/Content.aspx?pageid=59>.

1. **Program financing obligations:** As discussed in Section 2, states may use one of the following mechanisms for determining manufacturer obligations:

- *Market Share*
- *Return Share*
- *Hybrid Market/Return Share*
- *Funding Obligation Mechanism Not Specified*

Market share, return share, or hybrid systems have been developed primarily in response to the circumstances in a particular state and the needs of the stakeholders involved. Typically, the IT industry has preferred a return share approach. Market share systems tend to be less administratively burdensome (and therefore lower cost) for recyclers, since there is no need to track brand returns; however, state administrative burdens may be higher as a result of the need to calculate manufacturer obligations.

The type of financing obligation does not appear to correlate with program performance, but the fact that a financing obligation is specifically assigned clearly does. The 14 programs with the highest per-capita recycling rates specify a mechanism for defining the manufacturer's funding obligation.

2. **Performance goals:** Thirteen states set performance goals that require a certain level of collection for recycling. State approaches to performance goals vary. Some set goals in statute and have them increase over the first few years, while others incorporate formulas that adjust the performance goals to reflect the reality of what is being collected as program data begin to be collected. Others combine those approaches or require manufacturer goals to be included in plans approved by the state. In most cases, manufacturers that do not meet their performance goals are monetarily penalized.

Performance goals are typically designed to provide an incentive for manufacturers to develop a robust collection infrastructure, while allowing flexibility in how they do that. However, goals that are set too low or that allow manufacturers to carry credits for exceeding their goals may hinder performance.<sup>25</sup> For example, in New York, manufacturers have typically contracted with recyclers for specified amounts of e-scrap that meet their performance goals. This approach often leaves collectors and recyclers with no support for the excess material collected once goals are met. In Minnesota, manufacturer collections exceeded the state's goal in the first year of the program. Manufacturers were able to use credits from their Year 1 collection toward their Year 2 goals, resulting in decreased collection in Year 2. Since then, Minnesota has amended its legislation to limit the amount of recycling credits that can be carried forward, while maintaining the statutory performance target. The lesson from states like New York and Minnesota is that performance goals should be set high enough to drive collection and tied to requirements to provide year-round collection services. The highest performing state, Vermont, combines performance goals with strong convenience requirements.

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<sup>25</sup> Six states allow recycling credits to be carried over into future years: Minnesota, Indiana, New Jersey, New York, Oregon, Wisconsin.

3. **Convenience requirements:** It is well known that, in the U.S., consumer convenience drives recycling collection programs. States that set convenience requirements seek to ensure sufficient infrastructure to facilitate strong participation. These requirements may specify the number of collection sites offered to consumers and their geographic diversity:
  - *Geographic convenience requirements* dictate that manufacturers support one or more physical, collection sites depending on population density. For example, Washington and Oregon require manufacturers to operate one collection site or service in each county and at least one for any city with a population of at least 10,000.<sup>26</sup>
  - *Rural convenience incentives* credit manufacturers with “bonus” pounds for equipment collected from rural locations. Manufacturers receive a 25 percent bonus, for example, when collecting electronic equipment in Wisconsin’s rural areas. Therefore 1,000 pounds of material collected in an urban area would be credited as 1,250 pounds if that equipment were instead collected in a rural area.
  - *Limited convenience requirements* allow manufacturers to provide collection through mail-back programs, physical collection sites, or collection events, but do not prescribe the number of sites required for serving a population.
  - *No convenience requirements:* no stipulations are provided about the location or number of sites needed to serve a population.
4. **Product scope:** The scope of products varies from state to state. All state programs accept laptops and computer monitors; 22 of 25 programs also accept televisions. This report groups product scope into the following three levels:
  - **Limited Product Scope:** These programs accept between 3-4 equipment types.
  - **Average Product Scope:** These programs accept between 5-6 equipment types.
  - **Comprehensive Product Scope:** These programs accept 10-17 equipment types.
5. **Disposal ban:** Banning electronics from waste disposal can drive participation in electronics recycling programs, although some states that have bans phase them in after the recycling infrastructure has been in place for a few years.
6. **Centralized collection and recycling program:** There are two models of centralized collection and recycling programs. In one model (Vermont, Oregon, Washington, and Rhode Island), the state typically contracts out or designates by statute the management of a centralized program that manages the collection network, makes arrangements with recyclers, and in some cases charges manufacturers their share. In another model (Connecticut and Maine), the state approves collectors and recyclers, and approves the rates that manufacturers pay to cover the cost of transportation, consolidation, and recycling. In the first case, manufacturers can opt-out of the centralized program, provided that their collection and recycling programs meet certain standards. Centralized programs may offer greater organizational and operational efficiencies, greater accountability, and provide greater insurance that collection programs will continue even if performance goals are met.

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<sup>26</sup> New York and Vermont have similar standards. New York also allows manufacturers to meet the convenience standard through mail-back programs, and Vermont requires three collection sites per county instead of one.

7. **Covered entities:** The range of covered entities varies between states. All programs accept CEDs from consumers. This analysis groups product scope into the following three levels:

- **Limited Covered Entities:** These programs accept CEDs from households only, or from households and one other entity.
- **Average Covered Entities:** These programs accept CEDs from 3-4 entities.
- **Comprehensive Covered Entities:** These programs accept CEDs from 5 or more entities.

### *Program Performance Summary*

As evidenced by the data presented in the tables below, the programs with the highest per-capita collection rate offer a centralized collection and recycling program and/or set strong convenience standards. This is likely because both policy instruments lead to the creation of robust infrastructure with year-round financial support, regardless of the volumes collected.

The relationship of performance goals to program performance is inconclusive. While three of the top-performing states have performance standards, in other instances, performance standards have kept collection at the target level instead of fostering a robust, year-round collection system. Product scope also has less influence than one might expect. While a broader product scope will capture more materials, the programs with the broadest scope (Illinois and New York) are not among the top performers. Similarly, a broad range of covered entities will capture more materials but will not necessarily improve performance, as only one high-performing state has a broad range of covered entities. Rather, the most important factor is whether the program collects televisions: three of the four programs (Missouri, Oklahoma, and Virginia) with the lowest collection rates do not include TVs as CEDs. This finding is not surprising as televisions, especially older CRT-based units, comprise the majority of scrap electronics by weight (see Figure 2). Similarly, as the majority of televisions are purchased for the household market, a broader range of covered entities is unlikely to significantly increase the number of televisions collected.

Public education and outreach is another important element impacting performance, but is much more difficult to assess and measure. Washington's program has increased the amount of electronics recycled each year since the program's implementation in 2009, with an overall 17 percent increase from 2009 to 2013. Government officials overseeing the program report that this success is at least partially attributable to continuous and targeted public education by the manufacturers, state and local governments, and retailers, and that this outreach and education is as important as convenience to the success of the state's program.

### *E-Scrap Recycling and Greenhouse Gas Emissions*

Electronics recycling has significant benefits in terms of greenhouse gas (GHG) reduction, largely due to avoided emissions for producing virgin materials that comprise electronics, including metals and plastics. The U.S. Environmental Protection Agency has developed the *Electronics Environmental Benefits Calculator* (EIBC),<sup>27</sup> which can be used to estimate greenhouse gas reductions from recycling computer equipment. Approximately 1.4 million metric tons of scrap electronics was recycled through the state EPR programs in 2012,<sup>28</sup> resulting in 5.3 million metric tons of avoided GHG emissions,

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<sup>27</sup> Available on the U.S. EPA website, at: <http://www2.epa.gov/fec/publications-and-resources#calculator>.

<sup>28</sup> Available on the website of the Electronics Recycling Coordination Clearinghouse (ERCC), at: <http://www.ecycleclearinghouse.org/Content.aspx?pageid=59>.

expressed as CO<sub>2</sub> equivalents. This calculation accounts for GHGs emitted from the recycling and recovery process, but does not include emissions from collecting and transporting scrap electronics.

**Table 6: Program Performance and Program Design in High Performing States, 2012**

State (implementation date)	Pounds per capita 2012*	Program financing	Performance Goals	Convenience Requirements	Product Scope	Disposal Ban	Centralized program	Covered Entities
Vermont (2011)	7.7	Market share	Yes	Geographic	Average	Yes	Yes	Average
Oregon (2009)	6.8	Hybrid	Yes <sup>29</sup>	Geographic	Average	Yes	Yes	Average
Wisconsin (2010)	6.8	Market share	Yes	Rural convenience	Comprehensive	Yes	No	Limited
Minnesota (2007)	6.5	Market share	Yes	Rural convenience	Comprehensive	Yes	No	Limited
Washington (2009)	6.4	Hybrid	No	Geographic	Average	No	Yes	Comprehensive

**Table 7: Program Performance and Program Design in Average Performing States, 2012**

State (implementation date)	Pounds per capita 2012*	Program financing	Performance Goals	Convenience Requirements	Product Scope	Disposal Ban	Centralized Program	Covered Entities
Indiana (2010)	4.2	Market share	Yes	Rural convenience	Comprehensive	Yes	No	Average
New York (2011)	4.0	Market share	Yes	Limited	Comprehensive	Yes	No	Comprehensive
Connecticut (2011)	3.2	Hybrid	No	Municipal Collection	Average	Yes	No	Limited
Maryland (2006)	3.2	Unspecified	No	No	Limited	No	No	Limited

<sup>29</sup> Oregon has a program goal for all manufacturers, but only manufacturers who do not participate in the centralized program are penalized if their opt-out program fails to meet a performance goal.

**Table 8: Program Performance and Program Design in Low Performing States, 2012**

State (implementation date)	Pounds per capita 2012*	Program financing	Performance Goals	Convenience Requirements	Product Scope	Disposal Ban	Centralized Program	Covered Entities
South Carolina (2011)	0.7	Market Share	Yes	Limited	Average	Yes	No	Limited
Oklahoma (2009)	0.6	Funding Obligation Mechanism Not Specified	No	Limited	Limited	No	No	Limited
Virginia (2009)	0.4	Funding Obligation Mechanism Not Specified	No	Limited	Limited	No	No	Limited
Missouri (2010)	0.3	Funding Obligation Mechanism Not Specified	No	Limited	Limited (No TVs)	No	No	Limited

### Emerging Issues

One impact attributable to electronics EPR programs is the growing supply of post-consumer cathode ray tube (CRT) glass. State electronics EPR programs and CRT disposal bans are successfully diverting CRTs from disposal, yet the demand for this leaded glass material in the U.S. has precipitously dropped. “Glass-to-glass” recycling (i.e., recycling collected CRT glass into new CRT glass), once the most prevalent use of processed CRT glass, used to yield the highest market value for collected CRT. However, with the decline in CRT production—attributed largely to popular demand for flat screen monitors and TVs—this once higher value market has dwindled, sending costs for CRT recycling (such as lead smelting) skyrocketing. When recycler revenue does not keep pace with CRT recycling costs, the cost imbalance increases the potential for CRT stockpiling or illegal disposal.

### Design for the Environment

Though many states implement EPR programs in the hopes of encouraging design for the environment (DfE), it is not necessarily an explicit objective of state legislation. In fact, the degree to which EPR laws affect DfE needs further study and evaluation, as their relationship is not yet fully understood. Additionally, tools other than EPR—such as the European Union’s Restriction of Hazardous Substances (RoHS) Directive—may have a greater impact on DfE changes. Currently, only six states require manufacturers to disclose whether their products exceed the maximum concentration of hazardous substances specified under the RoHS Directive. One of those states (New Jersey) requires manufacturers to phase-out the use of RoHS substances.

Another national program that has significantly impacted the design of electronic equipment is the Electronic Product Environmental Assessment Tool (EPEAT). Initiated with the support of EPA, the tool serves as an independent environmental rating system that helps purchasers identify greener electronic equipment. The rating system was developed through extensive stakeholder engagement and addresses multiple environmental attributes. Manufacturers that meet EPEAT environmental standards submit

information to the registry; once the information is verified, the product is listed in a searchable database. More than 1,900 computer products and more than 500 imaging equipment products are currently listed on the EPEAT registry.

## VI. COST EFFECTIVENESS AND BENEFITS

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While robust collection of electronic scrap is a primary goal of EPR programs, it is also helpful to track and analyze both cost and performance where possible. Statewide electronics collection and recycling can be a costly endeavor for manufacturers and other stakeholders. Understandably, manufacturers seek to manage program costs while ensuring compliance and effective implementation.

Not every state tracks program costs, and those that do tend to only track administrative costs incurred by the state agency charged with program oversight. These costs are tracked for the purpose of setting program registration fees, the mechanism used by some states to recoup these costs. In most states, costs to collect, transport, and recycle electronics are incurred and negotiated between manufacturers and recyclers in the private market, where these costs are considered confidential business information. Therefore, total program costs are only calculated and reported by those states offering manufacturers a central collection and recycling program (Vermont, Oregon, Washington, and Rhode Island). Maine and Connecticut approve rates at which manufacturers reimburse recyclers for the costs of transportation, consolidation, and recycling.

### *Cost Estimates*

A 2010 report estimated nationwide costs for the 19 EPR programs in operation at that time. It estimated that the total cost (including program and registration fees) of EPR programs to the electronics manufacturing industry was **\$90 million**. Below are the different costs associated with compliance:<sup>30</sup>

- **\$71 million** for collection, transportation, and recycling
- **\$14 million** for internal compliance costs
- **\$4.5 million** for government-incurred administrative costs

Typically, program costs are evaluated on a cents-per-pound collected basis. While not all cost reporting is transparent, typically the cost-per-pound calculations include transportation, consolidation, and recycling; it is unlikely that these costs include education and outreach. Costs vary widely among state programs—the 2010 report cites state costs at \$0.20 to \$0.30 per pound. There can even be substantial differences within the same state program. For example, the Connecticut program approves recyclers that can service municipal collectors and also approves the rate those recyclers can charge manufacturers for transportation, consolidation, and recycling. Approved recycler rates currently vary

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<sup>30</sup> Source: National Electronics Recycling Infrastructure Clearinghouse, “Updated Manufacturer E-Waste Compliance Study,” March 29, 2009. Internet archive <http://web.archive.org/web/20130913045004/http://www.ecyclingresource.org/ContentPage.aspx?Pageid=34&ParentID=0>, accessed April 4, 2014.

from \$0.28 to \$0.34 per pound;<sup>31</sup> in prior years the spread was even greater. In Maine, approved rates in 2010 ranged from \$0.24 to \$0.36 per pound.<sup>32</sup>

**Table 9: Average Cost per Pound to Manufacturers for State Programs, 2012**

State	Average Cost Per Pound
Maine <sup>33</sup>	\$0.24 to \$0.36
Oregon <sup>34</sup>	\$0.26
Washington <sup>35</sup>	\$0.27
Connecticut <sup>36</sup>	\$0.28 to \$0.34
Vermont <sup>37</sup>	\$0.31
Rhode Island <sup>38</sup>	\$0.32

Many factors impact these average costs per pound. The major cost driver in Maine’s program is the cost of transporting relatively small amounts of material over long distances because Maine has the highest percentage of its population living in rural areas. Since manufacturers must pay for the costs of all material collected in all parts of the state, they cannot minimize costs by meeting collection goals through servicing more densely populated areas only. Additionally, because Maine’s program does not include the higher-value desktop computers as CEDs, the recycling value of the stream is reduced.<sup>39</sup>

<sup>31</sup> *Approved Prices for CT DEEP-Approved Covered Electronics Recyclers*, <http://www.ct.gov/deep/lib/deep/e-waste/approvedcerprices.pdf>

<sup>32</sup> *Report on Maine’s Household E-waste Recycling Program* <http://www.maine.gov/dep/waste/publications/legislativereports/documents/2010ewastereportfinal.pdf>.

<sup>33</sup> *Report on Maine’s Household E-waste Recycling Program*, <http://www.maine.gov/dep/waste/publications/legislativereports/documents/2010ewastereportfinal.pdf>

<sup>34</sup> Personal communication, Jason Linnell, Executive Director, National Center for Electronics Recycling, May 29, 2014.

<sup>35</sup> *E-Cycle Washington Standard Plan 2013 Annual Report* <http://www.ecy.wa.gov/programs/swfa/eproductrecycle/docs/2013AnnualReportfromWMMFA.pdf>

<sup>36</sup> *Approved Prices for CT DEEP-Approved Covered Electronics Recyclers*, *op. cit.*

<sup>37</sup> *2014 E-Cycles Report to the Legislature*, <http://www.anr.state.vt.us/dec/e-waste/pdfs/Final2014ECyclesReport.pdf>

<sup>38</sup> Personal communication, Mike McGonagle, Director of Information Systems and Business Analysis, Rhode Island Resource Recovery Corporation. May 29, 2014. This does not include the \$0.11 that manufacturers were invoiced to cover a program deficit from the prior year.

<sup>39</sup> Personal communication, Carole Cifrino. Program Manager, Product Management Programs Maine Department of Environmental Protection, May 21, 2014.

It should also be noted that the costs presented in Table 9 are only applicable to manufacturers participating in the state collection program. Comparable data for manufacturers that have opted out of state plans are not publically available. While the majority of manufacturers originally opted in to Rhode Island's state plan, for example, when the program was launched in 2009, since that time, the majority of manufacturers have opted out of the state collection plan.

### *Other Issues Affecting Costs*

Multiple factors influence program costs. For example, CRTs are costly to handle, while IT equipment can be a revenue generator. As the volume of CRTs goes down over time and the proportional volume of IT equipment increases, program costs are expected to decline. Another factor influencing cost is the degree to which programs operate in rural areas of a state, which are more expensive to service. The lack of national harmonization of state programs also adds costs. Most state agencies/departments that oversee a state EPR program collect registration fees from manufacturers, and most use fees to cover administrative costs. A more efficient approach would coordinate implementation activities nationally through federal or model state legislation and voluntary industry managed programs. Until greater harmonization across states occurs, organizations like the Electronics Recycling Coordination Clearinghouse reduce administrative overlap between state agencies/departments through inter-state collaboration on key issues and centralized reporting systems.

### *Importance of Internal Compliance Costs*

While cost-per-pound metrics generally include collection, transportation, and recycling costs, manufacturers' internal compliance costs are rarely reported. Manufacturers incur labor and contractual costs to effectively coordinate efforts throughout their companies and across state programs to successfully meet obligations, as well as state-by-state regulatory compliance, including reporting and registration. Manufacturers report that their costs are driven up by the broad disparity in state requirements, although data on specific costs is unavailable.

### *Electronics Recycling Job Benefits*

E-scrap product stewardship laws are effective drivers of economic development and job creation. According to a recent study for the Coalition for American Electronics Recycling (CAER), the U.S. electronics recycling industry employs approximately 6,850 people at an estimated annual payroll of \$250 million.<sup>40</sup> The Institute of Scrap Recycling Industries estimates that more than 30,000 people are employed in the electronics recycling industry.<sup>41</sup>

At the state-level, in 2014, Washington estimated that its electronics EPR program had created 125 jobs for businesses in the state providing collection, transportation, and processing services.<sup>42</sup> Within nine

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<sup>40</sup> *Jobs Through Electronics Recycling: Membership Survey and Jobs Study of the Potential of the U.S. Electronics Recycling Industry*, prepared for Coalition for American Electronics Recycling. DSM Environmental Services, Inc. January 2013.

<sup>41</sup> *Assessment of Efforts to Restrict the Trade of Electronic Scrap on Recycling Industry Jobs and Exports*, John Dunham & Associates, 2013.

<sup>42</sup> "E-Cycle Washington Turns 5," <http://www.wmmfa.net/fifthyear.jpg>

months after Oregon's program was implemented, 61 new jobs had been created.<sup>43</sup> A more comprehensive study for the Illinois Recycling Association estimates 8,000 jobs resulting from recycling and reusing unwanted electronics. Illinois' estimate includes direct effects and indirect effects (jobs created from industries that are suppliers to electronic recyclers), as well as induced effects (jobs created when workers from direct and indirect industries spend their wages to purchase goods and services).<sup>44</sup>

## VII. COMPETITION AND MARKET BARRIERS

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Since EPR significantly increases the amount of material available for recycling, and some scrap electronics have good value, in many states, new recyclers have entered the market and created more competition. The competitive environment for recyclers varies significantly from state to state based on certain program parameters and policy choices. For example, states like Pennsylvania, New York, and Minnesota allow manufacturers flexibility in meeting their recycling obligations, fostering unfettered competition among recyclers serving those states. In other states, like Washington, and Vermont, the state or its designated/contracted entity approves the recycler(s), thereby managing competition among recyclers through competitive bidding or state approval processes.

States with a more competitive environment tend to drive down costs for manufacturers, but may also trim profit margins for recyclers. In these states, recyclers compete both to access supply and serve manufacturers' compliance needs. Competition for supply can drive up recycler costs, while competition for manufacturer compliance services can drive down revenues. Furthermore, open competition in these states encourages more firms to enter the recycling market. Some, but not all, of these recyclers are R2 or e-Stewards certified. Third-party certified recyclers have expressed concerns that their already slim profit margins may be further undercut by less reputable recyclers.<sup>45</sup>

In addition to those mentioned above, the following issues also affect program costs, implementation, and performance:

- **Unpredictable quantity and value of electronic scrap stream:** As illustrated in Section V, equipment that contains high-value materials (laptops and desktop computers) represent a small fraction of the e-scrap stream managed in most state programs, while high-cost CRT TVs and monitors dominate the stream in most states.
- **The "Low-Hanging Fruit" Problem:** Certain equipment types tend to be targeted first for collection and recycling. While manufacturers tend to target the heaviest materials from locations with the best infrastructure, recyclers tend to target the most profitable material. Unless incentives or mandates are in place, underserved communities with poor infrastructure will likely continue to

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<sup>43</sup> "Preliminary Analysis of E-Cycle Programs in Washington and Oregon," report to Northwest Product Stewardship Council, March 2010.  
<http://productstewardship.net/PDFs/productsElectronicsEcycleWAORReport.pdf>

<sup>44</sup> "2010 Recycling Economic Information Study Update for Illinois," prepared by DSM Environmental Services, November 2010.

<sup>45</sup> Product Stewardship Institute. *Evaluation of the New York State Electronics Producer Responsibility Law*. 2013.

struggle. In states with performance standards, at some point the programs will need to reach further to get material, probably at an increased cost. For similar reasons, some states have seen the issue of collector “scavenging” of valuable items. Typically, IT equipment can be resold outside of the EPR program to brokers or scrap dealers at a high price, leaving the EPR program to manage negative value items such as CRTs.

- **Availability of Landfilling:** In states without disposal bans, landfills may offer a cheaper, more convenient alternative to recycling. Yet, in certain states with disposal bans, such as California and Vermont, decisions to allow recyclers to landfill CRT glass or use it as an alternative daily cover has compounded the landfilling problem. While these decisions are intended to help recyclers in a difficult CRT market, if sustained, they effectively undermine the existing, albeit negative value, CRT recycling markets and discourage new investments in CRT recycling.

## VIII. CONCLUSION

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State level e-scrap product stewardship legislation has been successful on many fronts. It has led to the development of significant collection infrastructure in many of the states analyzed. It has also yielded notable increases in e-scrap recycling. As states have begun to require third-party certification of e-scrap recyclers serving their programs, and manufacturers have tended to contract with third-party certified recyclers, the environmental performance of the e-scrap recycling industry appears to have improved.

The 25 state programs evaluated in this report have taken different paths to e-scrap product stewardship and, as such, have had very different outcomes. In terms of materials diverted from the waste stream, the performance of state-level e-scrap programs varies widely—from less than one to more than 7 pounds-per-capita captured annually. These dramatic differences are likely due to a great diversity in program structure, roles and responsibilities of different stakeholders, and level of public outreach and education. Pounds of electronics per capita captured annually, the only metric available across programs, should be evaluated within the context of these other program elements – CEDs, covered entities, etc.

While there are strong performers among the many models of state-level e-scrap EPR programs, the data indicate the strongest per-capita performance levels correlate with a greater level of centralized program coordination and management, and with strong convenience standards. These program and policy choices have led to the development of an extensive and stable collection infrastructure with consistent, year-round support.

The experience in states that rely on performance standards to drive collection infrastructure has been more mixed. As a policy tool, performance standards create an expectation and incentive for manufacturers to establish collection programs, but allow them flexibility in the approach to achieving the standard. Three of the top four performing states have performance standards, while the other five states with performance goals are in the middle of the pack, in terms of per-capita collection. Thus, the data indicate that performance standards have clearly been effective in some instances, while in other cases, the standards have capped collection when manufacturers meet their performance goal. The lesson learned is that, if states choose to use performance standards as a primary program driver, the goals need to be high enough to encourage the development of a strong collection network with year-round financial support.

The results in the 25 states analyzed indicate that creating a financing mechanism with clear delineation of financial management responsibilities is a key indicator of high performers. Exactly which method of allocating financial responsibility is used (e.g., market share, return share, or hybrid) is not as important as the specific assignment of financial responsibility. A lack of specificity in allocating funding obligations correlates with lower performance.

Program costs are difficult to compare across programs as data are only available from a limited number of states (six). Program costs vary widely, due to a number of factors, including population density, number and types of CEDs included in the program, number of collection locations, and the recycling value of collected materials.

Perhaps the greatest challenge in moving forward is harmonizing the varying approaches used at the state level and expanding them to cover the remaining 45 percent of the U.S. population. The patchwork of state approaches leads to widely varying program performance, fosters inefficiency, and inflates program costs. A national model program would streamline program operations and mitigate these challenges. Such a model would ideally include the following program best practices:

- Broad scope of accepted CEDs (which can increase collection efficiency, apportion financial responsibility more fairly, capture more electronic materials, and simplify public messaging);
- Comprehensive range of covered entities;
- Manufacturer funded and led recycling program, including a strong public education and outreach component;
- Compliance enforcement to ensure a level playing field among manufacturers;
- Performance requirements with high goals that ensure continuous collection;
- Strong convenience requirements; and
- Minimum standards for processing and recycling e-scrap collected in the program, such as third-party certification programs.

# Appendix A

## List of Report Peer Reviewers

Melissa Adler-McKibben	Oklahoma Department of Environmental Quality
Walter Alcorn	Consumer Electronics Association
Jennifer Amelang	Texas Commission on Environmental Quality
Richard Chesley	South Carolina Department of Health and Environmental Control
Carole Cifrino	Maine Department of Environmental Protection
Steve Coe	Virginia Department of Environmental Quality
Garth Hickle	Minnesota Pollution Control Agency
Meredith Jones	Indiana Department of Environmental Management
Maroussia Klep	Organisation for Economic Co-operation and Development
Karen Knaebel	Vermont Agency for Natural Resources
Miles Kuntz	Washington State Department of Ecology
Jason Linnell	National Center for Electronics Recycling
Michele Martin	Oregon Department of Environmental Quality
Matt McCarron	California Department of Toxic Substances Control
Mike McGonagle	Rhode Island Resource Recovery Corporation
Wendy Okazaki	Hawaii Department of Health
Andrew Prag	Organisation for Economic Co-operation and Development
Lynn Rubinstein	Northeast Recycling Council

## Appendix B

### Comparison of United States Scrap Electronics Product Stewardship Laws by State

Program elements	California	Connecticut	Hawaii	Illinois
<b>Year Law Passed</b>	2003	2007	2008	2008; amended 2011
<b>Year Law Implemented</b>	2005	2011	2010	2010; 2011 amendments effective 2012
<b>Product scope</b>	Laptops, monitors, TVs, media tablets, portable DVD players; screen size 4 inches or larger	Desktop computers, laptops, monitors, TVs, printers, media tablets, e-readers; screen size 4 inches or larger	Desktop computers, laptops, monitors, TVs, printers, media tablets, e-readers; screen size 4 inches or larger	Desktop computers, laptops, monitors, TVs, printers, media tablets, e-readers, fax machines, scanners, keyboard/mouse, media players, portable DVD players, DVD players, VCRs, small scale servers, set top boxes, game consoles, PDAs, zip drives; screen size 4 inches or larger
<b>Covered Entities</b>	Households, all businesses, government agencies, and non-profits/charities	Household - any resident dropping off 7 or fewer items per day	Households, all businesses, government agencies, non-profits/charities, and schools	Households

<b>Program elements</b>	<b>California</b>	<b>Connecticut</b>	<b>Hawaii</b>	<b>Illinois</b>
<b>Program financing</b>	ADF	Initial registration fee. In subsequent years, annual registration fee is equal to the manufacturer's market share for the CEDs sold multiplied by the CT DEEP's annual budget for administering the program. Manufacturers finance the transportation and recycling of CEDs by participating in the state program and paying an approved recycler's reasonable costs for transporting and recycling the CEDs attributed to the manufacturer. Recyclers bill TV manufacturers by market share and all other CED manufacturers by return share.	Annual registration fee from manufacturers; Financing obligation by market share for TVs; not specified for other CEDs	Registration fee from manufacturer and each recycler/refurbisher; IT manufacturers pay by return share; TV manufacturers pay by market share.
<b>Performance goals</b>	None, and legislation does not authorize CA to set collection targets for manufacturers	None	Performance goal for TVs only, based on weight of TVs recycled in prior year and apportioned by market share	Statewide recycling goal originally apportioned to manufacturers; beginning in 2012 each manufacturer responsible for recycling at least 40% (increased to 50% starting in 2013) of market share.

<b>Program elements</b>	<b>California</b>	<b>Connecticut</b>	<b>Hawaii</b>	<b>Illinois</b>
<b>Convenience standards</b>	Collection to be "cost free and convenient."	Municipalities or regional recycling program to collect CEDs and arrange transportation to covered electronic recyclers. Municipalities must submit a plan for approval to DEEP indicating how they will provide convenient and accessible collections for their residents.	None	2x weight for underserved counties
<b>Outreach and Education Requirements</b>		Municipalities required to educate their residents on the specifics of how to participate in the program.	State maintains a web site	State uses portion of registration fees for each county to educate residents; manufacturer education program to promote recycling and proper end-of-life management
<b>Stewardship plan contents, if required</b>	N/A	State plan, but no stewardship plan required	Individual or collaborative recycling plan required from manufacturers. Submit a plan to the department (DOH) to establish, conduct, and manage a program for the collection, transportation, and recycling of its covered electronic devices sold in the State.	None

Program elements	California	Connecticut	Hawaii	Illinois
<b>Reporting requirements by states, manufacturers, collectors, recyclers</b>	Manufacturers' annual report includes: (A) Number of devices sold; (B) Amounts of hazardous materials used, and reduction from the previous year (specifically mercury, cadmium, lead, hexavalent chromium, PBBs); (C) Amount of recyclable materials used in covered devices sold, and increase from the previous year; (D) Description of any efforts to design for recycling (DfE), and future goals and plans to increase DfE; (E) list of retailers which the manufacturer notified regarding the ARF, per Section 42465.3 and subdivision (c) of Section 25214.10.1 of the Health and Safety Code.	State prepares initial report, every 3 years thereafter.	Weight of own and other manufacturer CEDs and TVs recycled	IL EPA, manufacturer, and collectors report annually (no recycler report); manufacturers report total weight recycled or processed for reuse, list of recycler, refurbisher, and collector used; collector report total weight collected or received for each manufacturer, total weight that collector provided each recycler and refurbisher
<b>Penalties for violation (registration, not meeting collection goals)</b>	For selling devices for which the fee has not been paid; for manufacturers that fail to comply; for misrepresentation or making false statements	For non-payment of recycling costs	If not registered; penalties for not meeting TV recycling goals	If not registered, if don't meet recycling or reuse goals

Program elements	California	Connecticut	Hawaii	Illinois
<b>Disposal Ban (landfill, incineration, all solid waste facilities)</b>	Landfill ban (existing law)	Landfill and incineration ban	None	Landfill and incineration ban
<b>State Procurement Requirements</b>		None	For TVs only -- state and county agencies can only purchase or lease TVs offered by manufacturers that are in compliance with the TV recovery section of the law.	EPEAT bronze or higher
<b>Hazardous material statements (RoHS)</b>	Manufacturers must notify retailers that electronics are	None	None	must disclose if any products exceed RoHS
<b>Reuse incentives</b>				2x weight incentive for reuse; 3x reuse for educational institutions
<b>Recycler certification requirements (R2 &amp; e-Stewards)</b>		no	No	No
<b>Local Government: Responsibilities and Benefits (e.g., collection requirements and/or payments)</b>		Municipalities required to provide a free drop-off location for their residents to recycle CEDs and select a state-approved covered electronics recycler to collect CEDs.		
<b>Pounds per capita recycled in 2012</b>	5.7	3.2	2.8	3

<b>Program elements</b>	<b>Indiana</b>	<b>Maine</b>	<b>Maryland</b>	<b>Michigan</b>
<b>Year Law Passed</b>	2009; amended 2012	2004, revised 2009, revised 2011	2005; revised 2007	2008
<b>Year Law Implemented</b>	2010; amendments change program year to be the same as calendar year	2006	2006	2010
<b>Product scope</b>	Manufacturers of video display devices (laptops, monitors, TVs, media tablets, and e-readers; screen size 4 inches or larger) may also accept CEDs (desktop computers, keyboards, printers, fax machines, DVD players, VCRs digital picture frames, digital media players, MPE players, camcorders, cameras, DVRs, portable GPS systems, VDDs or peripherals)	Laptops, monitors, TVs, printers, media tablets, e-readers, media players, portable DVD players, game consoles, digital picture frames; screen size 4 inches or larger	Desktop computers, laptops, monitors, TVs, media tablets, e-readers, digital picture frames; screen size 4 inches or larger	Desktop computers, laptops, monitors, TVs, printers; screen size 4 inches or larger
<b>Covered Entities</b>	Households, small businesses (<100 employees), public schools including charter schools but not colleges and universities	Households, small businesses and non-profits with fewer than 100 employees, schools	Households, all businesses, government agencies, non-profits/charities	Households, businesses with fewer than 7 employees; <8 items per day
<b>Program financing</b>	VDD manufacturers pay initial and then annual registration fee. Market share obligation based on VDD sales	Registration fee (implemented in 2009). Manufacturers who opt in to state standard plan: Maine DEP-approved consolidators perform a brand count and contract with a	Registration fee; pay lower fee if operate own take-back program. State reimburses counties for electronics recycling. Financing obligation	Registration fee. Financing obligation mechanism not specified.

Program elements	Indiana	Maine	Maryland	Michigan
		<p>qualified recycling and dismantling facility, then bill the manufacturer for the costs associated with handling, transportation and recycling based on the weight of the manufacturer's products received plus the manufacturer's share of orphan products (if any). If opt-out, manufacture pays consolidator costs but contracts with a recycler. Manufacturers of monitors and desktop printers are invoiced for their actual product in the waste stream plus any orphan share responsibility as determined by Maine DEP on a basis proportional to the best available data on products in the waste stream. Television and video game console manufacturers' "recycling share" responsibility is determined proportional to market share so that recycling of all units is provided for, including orphans.</p>	<p>mechanism not specified.</p>	

<b>Program elements</b>	<b>Indiana</b>	<b>Maine</b>	<b>Maryland</b>	<b>Michigan</b>
<b>Performance goals</b>	Manufacturers must collect and recycle CEDs equivalent to 60%, by weight, of VDD sales. Can bank credits for 3 years for surpassing recycling goals.	None	None	None. (Non-binding goal of 60% by weight of previous year's sales).
<b>Convenience standards</b>	1.5x weight for material collected outside metropolitan areas	Each municipality must ensure that their residents have a collection site or event	None	"Reasonably" convenient to be met by any of the following means: mail take-back, permanent collection site, collection events, retailer take-back (computers only)
<b>Outreach and Education Requirements</b>	state responsible for promoting public participation			manufacturer web site
<b>Stewardship plan contents, if required</b>	None	None	Municipalities must submit recycling plans	None

<b>Program elements</b>	<b>Indiana</b>	<b>Maine</b>	<b>Maryland</b>	<b>Michigan</b>
<b>Reporting requirements by states, manufacturers, collectors, recyclers</b>	IDEM annual report. Manufacturer, collectors and recyclers must submit annual report. Manufacturers report total weight of VDDs sold, weight of CEDs collected and recycled. Collectors report quantities collected and recyclers to which they delivered CEDs. Recyclers report total weight recycled and weight taken for final disposal.	Report to legislature		manufacturer reports total weight of CEDs received, processes and methods used to recycle or reuse collected CEDs, identify of collectors or recyclers who manufacturer contracts
<b>Penalties for violation (registration, not meeting collection goals)</b>	For not meeting recycling goals	For non-payment of collection costs	For retailers violating sales prohibition	Yes
<b>Disposal Ban (landfill, incineration, all solid waste facilities)</b>	Effective 1/1/11, households. Public schools, and small businesses cannot dispose of e-waste (VDDs and CEDs)	Yes	None	None
<b>State Procurement Requirements</b>	None			
<b>Hazardous material statements (RoHS)</b>	Companies must disclose display devices exceeding ROHS levels for lead, mercury, cadmium,	None	None	None

<b>Program elements</b>	<b>Indiana</b>	<b>Maine</b>	<b>Maryland</b>	<b>Michigan</b>
	hexavalent chromium, PBBs, PDBEs			
<b>Reuse incentives</b>				
<b>Recycler certification requirements (R2 &amp; e-Stewards)</b>				
<b>Local Government: Responsibilities and Benefits (e.g., collection requirements and/or payments)</b>		Municipalities required to pay cost of collecting and shipping CEDs to consolidators		
<b>Pounds per capita recycled in 2012</b>	4.2	5.6	3.2	2.4

<b>Program elements</b>	<b>Minnesota</b>	<b>Missouri</b>	<b>New Jersey</b>	<b>New York</b>
<b>Year Law Passed</b>	2007	2008	2008	2010
<b>Year Law Implemented</b>	2007	2010	2011	2011
<b>Product scope</b>	Manufacturers of video display devices (laptops, monitors, TVs, media tablets, e-readers, and digital picture frames; screen size greater than 9 inches) must register but may also accept CEDs (desktop computers, keyboards, printers, fax machines, DVD players, VCRs, digital media players, MPE players, camcorders, cameras, DVRs, portable GPS systems, VDDs or peripherals)	Desktop computers, laptops, monitors; no screen size specified	Desktop computers, laptops, monitors, TVs, media tablets, e-readers; screen size 4 inches or larger	Desktop computers, laptops, monitors, TVs, printers, media tablets, e-readers, fax machines, scanners, keyboard/mouse, media players, portable DVD players, DVD players, VCRs, small scale servers, set top boxes, video game consoles, digital picture frames; screen size 4 inches or larger (NY also covers cell phones under a separate law)
<b>Covered Entities</b>	Households	Households (personal or home business computers)	Households, businesses with fewer than 51 employees	Households, schools, non-profits <75 employees, government agencies, small businesses <51 employees, large businesses

<b>Program elements</b>	<b>Minnesota</b>	<b>Missouri</b>	<b>New Jersey</b>	<b>New York</b>
<b>Program financing</b>	Registration fee. Financing obligation by market share.	Financing obligation mechanism not specified	Registration fee. IT manufacturers pay by return share; TV manufacturers pay by market share.	Registration fee. Financing obligation by market share.
<b>Performance goals</b>	Year 1: 60% of weight sold in previous year. Years 2 and on: 80% of weight sold in previous years. Manufacturers receive credits for weight collected above goal - these can be applied to future years or traded.	None	Goals set for individual manufacturers annually by NJDEP. Manufacturers receive credits for weight collected above goal - these can be applied to future years or traded.	Yes. Per-capita statewide target based on weight of electronics recycled over the previous 3 years apportioned to manufacturers by market share. Manufacturers receive credits for weight collected above goal - these can be applied to future years or traded.
<b>Convenience standards</b>	1.5 x weight for material collected outside metropolitan areas	"Reasonably" convenient and meet the collection needs of consumers by any of the following means: mail take-back, permanent collection site, collection events, retailer take-back	The department will ensure that there is at least one electronics collection in each county, with access to all consumers in the county. No unreasonable limits on quantities that can be dropped off by consumers.	At least one collection method in every county, and in every city with a population of at least 10,000. Acceptable methods include mail-back programs and collection events; does not have to be a permanent site
<b>Outreach and Education Requirements</b>				

<b>Program elements</b>	<b>Minnesota</b>	<b>Missouri</b>	<b>New Jersey</b>	<b>New York</b>
<b>Stewardship plan contents, if required</b>	None	manufacturer adopts and implements a "recovery" plan and submits it to DNR	manufacturers must submit an electronics waste management plans that includes how the program will be financed	None
<b>Reporting requirements by states, manufacturers, collectors, recyclers</b>		Weight of CEDs collected, recycled, and reused		
<b>Penalties for violation (registration, not meeting collection goals)</b>	Yes	Yes	if performance standards not met, department may order producer to take necessary action to meet targets	For failure to submit reports or required fees; for retailers not complying with sales prohibition; for failure to meet goals
<b>Disposal Ban (landfill, incineration, all solid waste facilities)</b>	Yes	None	Disposal ban	Disposal ban
<b>State Procurement Requirements</b>		None		
<b>Hazardous material statements (RoHS)</b>	Companies must disclose display devices exceeding ROHS levels for lead, mercury, cadmium, hexavalent chromium, PBBs, PDBEs	None	Companies must be ROHS compliant on heavy metals	Companies must disclose any products for sale that do not comply with ROHS.

<b>Program elements</b>	<b>Minnesota</b>	<b>Missouri</b>	<b>New Jersey</b>	<b>New York</b>
<b>Reuse incentives</b>				
<b>Recycler certification requirements (R2 &amp; e-Stewards)</b>				
<b>Local Government: Responsibilities and Benefits (e.g., collection requirements and/or payments)</b>				
<b>Pounds per capita recycled in 2012</b>	6.5	0.3	5.4	4

Program elements	North Carolina	Oklahoma	Oregon	Pennsylvania
<b>Year Law Passed</b>	2007	2008	2007	2010
<b>Year Law Implemented</b>	2010	2009	2009	2012
<b>Product scope</b>	Desktop computers, laptops, monitors, TVs (screen size 9 inches or larger), printers, scanners, keyboard/mouse	Desktop computers, laptops, monitors, media tablets, e-readers; no screen size specified	Desktop computers, laptops, monitors, televisions, media tablets, (printers as of Jan '15); screen size 4 inches or larger	Desktop computers, laptops, monitors, TVs, media tablets, e-readers (manufacturers of only keyboard/ mouse or printers do not have to register but devices are covered); screen size 4 inches or larger
<b>Covered Entities</b>	Households, non-profits <10 employees	Households (personal or home business computers)	Households, businesses or non-profits with fewer than 11 employees; any resident dropping off 7 or fewer items per day	Households, businesses with fewer than 51 employees
<b>Program financing</b>	Registration fee. TV manufacturers pay by market share; financing obligation not specified for all other covered electronic devices.	Financing obligation mechanism not specified.	Registration fee. IT manufacturers pay by return share, TV manufacturers pay by market share.	Annual registration fee. Financing obligation by market share.
<b>Performance goals</b>	Performance goal for TVs only, based on weight of TVs recycled in prior year and apportioned by market share	None	Only manufacturers who do not participate in centralized state program must meet a performance goal. Manufacturers receive credits for weight collected above goal - these can be applied to future years or traded.	Yes. Manufacturers must increase collection by 2% by weight per year.

<b>Program elements</b>	<b>North Carolina</b>	<b>Oklahoma</b>	<b>Oregon</b>	<b>Pennsylvania</b>
<b>Convenience standards</b>	At a minimum (Level 1 plan) either a mail-back program, collection site, or collection event; higher levels have more stringent standards and reduced fees	"Reasonably" convenient to be met by any of the following means: mail take-back, permanent collection site, collection events, retailer take-back	Convenient service in every county and at least one collection site for any city with a population of at least 10,000. County and city collection sites may be the same. Collection sites must be staffed and open to the public at a frequency adequate to meet the needs of the area being served.	None
<b>Outreach and Education Requirements</b>				
<b>Stewardship plan contents, if required</b>	There are 3 tiers of plans – the plans with the least rigor (tier 1) require slightly higher fees. Fees are used in part to reimburse local gov't recycling programs which meet certain criteria, including convenience. Market share for TV; return share IT	Recovery plan required	State plan, if manufacturers opt-out, must submit stewardship plan	Manufacturer plan required
<b>Reporting requirements by states, manufacturers, collectors, recyclers</b>	Annual report of collection and recycling services used; quantity of computer equipment sold; quantity collected for recovery. For TV manufacturers: total weight collected			

<b>Program elements</b>	<b>North Carolina</b>	<b>Oklahoma</b>	<b>Oregon</b>	<b>Pennsylvania</b>
<b>Penalties for violation (registration, not meeting collection goals)</b>	None	For manufacturers that fail to label covered devices or adopt and implement a recovery plan	For failure to register with the department; for failure to implement a program or join state program; for failure to meet goals; for retailers not complying with sales prohibition	For failure to submit a plan or pay the registration fee; for failure to label covered devices; for retailers not complying with sales prohibition; for any other violation of the act
<b>Disposal Ban (landfill, incineration, all solid waste facilities)</b>	Landfill ban, incineration ban	None	Disposal ban	Disposal ban for all CEDs effective 1/24/13
<b>State Procurement Requirements</b>				
<b>Hazardous material statements (RoHS)</b>	None	None	None	None
<b>Reuse incentives</b>				

<b>Program elements</b>	<b>North Carolina</b>	<b>Oklahoma</b>	<b>Oregon</b>	<b>Pennsylvania</b>
<b>Recycler certification requirements (R2 &amp; e-Stewards)</b>				R2 (Responsible Recycling Practices Standard) Certification, e-Stewards Certification, or an internationally accredited third-party environmental management standard for the safe and responsible handling of covered devices.
<b>Local Government: Responsibilities and Benefits (e.g., collection requirements and/or payments)</b>				
<b>Pounds per capita recycled in 2012</b>	4.4	0.6	6.8	2.5

Program elements	Rhode Island	South Carolina	Texas	Utah
<b>Year Law Passed</b>	2008; revised 2013	2010	2007; revised 2011	2011
<b>Year Law Implemented</b>	2009	2011	2008	2012
<b>Product scope</b>	Desktop computers, laptops, monitors, TVs; screen size greater than 9 inches	Desktop computers, laptops, monitors, TVs, printers; screen size 9 inches or larger	Desktop computers, laptops, monitors, TVs, media tablets, keyboard/mouse (must accompany computer equipment being recycled); screen size 4 inches or larger for laptops, 9 inches or larger for TVs	Computers (including laptop, desktop and tablet computer) and computer peripheral devices (including printers), televisions and television peripheral devices
<b>Covered Entities</b>	Households, public or private secondary or elementary schools	Households	Households (personal or home business computers)	Household (personal or home business)
<b>Program financing</b>	Registration fee. IT manufacturers pay by return share; TV manufacturers pay by market share.	Registration fee. TV manufacturers pay by market share; funding obligation not specified for all other covered electronic devices.	Registration fee for TV manufacturers only. TV manufacturers pay by market share; financing obligation not specified for all other covered electronic devices.	Unspecified

<b>Program elements</b>	<b>Rhode Island</b>	<b>South Carolina</b>	<b>Texas</b>	<b>Utah</b>
<b>Performance goals</b>	Yes, weight based recycling goal apportioned by market share to TV manufacturers and return shares for manufacturers of other CEDs (except TVs).	Performance goal for TVs only, based on weight of TVs recycled in prior year and apportioned by market share	None	None
<b>Convenience standards</b>	Programs must include staffed collection sites, and may not be limited to mail back programs. Manufacturer's plan must describe how they will provide convenient service statewide.	Convenience may be satisfied by offering a mail-back program. If the manufacturer does not offer mail-back, they must provide collection sites or events that are centrally located, working with the department to determine an appropriate number of sites and events.	"Reasonably" convenient to be met by any of the following means: mail take-back, permanent collection site, collection events, retailer take-back (TVs and computers)	None
<b>Outreach and Education Requirements</b>				Manufacturers must work with the department and interested parties to develop consumer educational materials about eligible recycling programs, such as packaging inserts, company websites, and other communication tools.

<b>Program elements</b>	<b>Rhode Island</b>	<b>South Carolina</b>	<b>Texas</b>	<b>Utah</b>
<b>Stewardship plan contents, if required</b>	State program or manufacturer opt-out with plan	None	Manufacturer recovery plan required	None
<b>Reporting requirements by states, manufacturers, collectors, recyclers</b>				Manufacturers must submit annual reports to the agency, either individually or collectively, including a list of eligible electronics recycling programs.
<b>Penalties for violation (registration, not meeting collection goals)</b>	For failure to meet goals; for any other violation of the act	None	For failure to label products; for failure to adopt and implement a recovery plan; for violation of sales prohibition	None
<b>Disposal Ban (landfill, incineration, all solid waste facilities)</b>	Disposal ban for all CEDs	Landfill ban	None	None
<b>State Procurement Requirements</b>				
<b>Hazardous material statements (RoHS)</b>	Companies must disclose video display devices sold that exceed ROHS.	None	None	None
<b>Reuse incentives</b>				

<b>Program elements</b>	<b>Rhode Island</b>	<b>South Carolina</b>	<b>Texas</b>	<b>Utah</b>
<b>Recycler certification requirements (R2 &amp; e-Stewards)</b>	Manufacturers' approved collection programs and the State Program shall, at a minimum, meet the environmentally sound management practices as set forth in the R2 2013 Responsible Recycling (R2) Standard for Electronics Recyclers.	Recoverers must at a minimum comply with the responsible recycling practices (R2/RIOS)		
<b>Local Government: Responsibilities and Benefits (e.g., collection requirements and/or payments)</b>				Local governments may enter into arrangements with manufacturers to facilitate electronics recycling without requiring a request for proposal or similar competitive process required by law.
<b>Pounds per capita recycled in 2012</b>	4.6	0.7	0.9	3.0

Program elements	Vermont	Virginia	Washington	West Virginia	Wisconsin
Year Law Passed	2010	2008	2006	2008	2009
Year Law Implemented	2011	2009	2009	2009	2010
Product scope	Desktop computers, laptops, monitors, TVs, printers, media tablets (manufacturers of only keyboard/mouse do not have to register but devices are covered); screen size 4 inches or larger	Desktop computers, laptops, monitors (manufacturers of only keyboard/mouse do not have to register but devices are covered); screen size not specified	Desktop computers, laptops, monitors, TVs, media tablets, e-readers; screen size 4 inches or larger	Desktop computers, laptops, monitors, TVs; screen size 4 inches or larger	Desktop computers, laptops, monitors, TVs, printers, media tablets, e-readers, small scale servers; screen size 7 inches or larger
Covered Entities	Households, businesses with fewer than 11 employees, non-profits, schools; any resident dropping off 7 or fewer items per day	Households (personal or home business computers)	Households, businesses and government agencies with fewer than 50 employees, schools, non-profits/charities	Households, schools, non-profits, government agencies, small businesses	Households, schools

<b>Program elements</b>	<b>Vermont</b>	<b>Virginia</b>	<b>Washington</b>	<b>West Virginia</b>	<b>Wisconsin</b>
<b>Program financing</b>	Registration fee. Financing obligation by market share.	Financing obligation mechanism not specified.	Registration fee. Producers pay all administrative and operation costs associated with collection, transportation, and recycling. Apportioned by return share.	Registration fee. Fees can be reduced by establishing a take-back program. Funding obligation mechanism not specified.	Registration fee. Financing obligation by market share.
<b>Performance goals</b>	Yes, per-capita statewide goal apportioned to manufacturers by market share.	None	None	None	Yes, 80% of weight sold into the state 3 years prior. Manufacturers receive credits for weight collected above goal - these can be applied to future years or traded.

<b>Program elements</b>	<b>Vermont</b>	<b>Virginia</b>	<b>Washington</b>	<b>West Virginia</b>	<b>Wisconsin</b>
<b>Convenience standards</b>	Programs must have three collection sites in each county and one site in every city of 10,000 or more.	"Reasonably" convenient to be met by any of the following means: mail take-back, permanent collection site, collection events, retailer take-back	One collection point in every county and in any city/town with a population over ten thousand. County and city collection sites may be the same. A program may provide collection services in forms different than collection sites, such as curbside services, if those alternate services provide equal or better convenience, or better feasibility for large-scale producers such as small businesses. In rural areas, a program may provide collection at the nearest commercial centers or solid waste sites, collection events, mail-back systems, or a combination of these options.	"Reasonably" convenient to be met by any of the following means: mail take-back, permanent collection site, collection events, retailer take-back	1.25x credit for weight collected from rural areas
<b>Outreach and Education Requirements</b>					

Program elements	Vermont	Virginia	Washington	West Virginia	Wisconsin
<b>Stewardship plan contents, if required</b>	State program or manufacturer opt-out with plan		Standard plan or individual plan must describe: the collection, transportation, and recycling systems and providers to be used, how providers will be compensated, how convenient collection will be provided in urban and rural areas (1/county and minimum 1/population >10K), how service will be provided to small businesses, governments, charities, and school districts; processes and methods used to recycle; documentation of audits/ accounting and reporting systems. Provide website info for covered entities on how to return CEDs for recycling Plan updated at least every 5 years		

<b>Program elements</b>	<b>Vermont</b>	<b>Virginia</b>	<b>Washington</b>	<b>West Virginia</b>	<b>Wisconsin</b>
<b>Reporting requirements by states, manufacturers, collectors, recyclers</b>			Annual report total weight of CEDs collected and recycled, collection services provided, weight of CEDs processed by each processor; educational and promotional efforts undertaken		
<b>Penalties for violation (registration, not meeting collection goals)</b>	For failure to meet goals	None	For failure to register, for failure to meet return share	For violating sales prohibition; for failure to register or pay registration fee	Yes
<b>Disposal Ban (landfill, incineration, all solid waste facilities)</b>	Landfill ban	None	No statewide ban - Some counties have bans	None	Yes
<b>State Procurement Requirements</b>			No		
<b>Hazardous material statements (RoHS)</b>	None	None	None	None	Manufacturers must declare which products they sell do and do not comply with ROHS.
<b>Reuse incentives</b>					

<b>Program elements</b>	<b>Vermont</b>	<b>Virginia</b>	<b>Washington</b>	<b>West Virginia</b>	<b>Wisconsin</b>
<b>Recycler certification requirements (R2 &amp; e-Stewards)</b>	R2 or E-Stewards certified		No		
<b>Local Government: Responsibilities and Benefits (e.g., collection requirements and/or payments)</b>					
<b>Pounds per capita recycled in 2012</b>	7.7	0.4	6.3	1.6	6.8

# Appendix C

## Scope of Products Included by State in U.S. Electronics Product Stewardship Laws

State	CA	CT	HI	IL	IN	ME	MD	MI	MN	MO	NJ	NY	NC	OK	OR	PA	RI	SC	TX	UT	VT	VA	WA	WV	WI
Desktop Computer	<input checked="" type="checkbox"/>																								
Laptop	<input checked="" type="checkbox"/>																								
Monitor	<input checked="" type="checkbox"/>																								
TV	<input checked="" type="checkbox"/>																								
Printer (desktop, unless specified)	<input checked="" type="checkbox"/>																								
Media Tablets	<input checked="" type="checkbox"/>																								
E-readers	<input checked="" type="checkbox"/>																								
Fax (stand alone)	<input checked="" type="checkbox"/>																								
Scanner (stand alone)	<input checked="" type="checkbox"/>																								
Keyboard/ Mouse	<input checked="" type="checkbox"/>																								
Media (Portable Audio/MP3/or Video) Player	<input checked="" type="checkbox"/>																								
Portable DVD Player	<input checked="" type="checkbox"/>																								
DVD Player (no display) or VCR	<input checked="" type="checkbox"/>																								
Small Scale Server	<input checked="" type="checkbox"/>																								
Set Top Boxes (cable and satellite)	<input checked="" type="checkbox"/>																								
Game console	<input checked="" type="checkbox"/>																								
Digital Picture Frames	<input checked="" type="checkbox"/>																								
Minimum Screen Size	4"	4"	4"	4"	4"	4"	4"	4"	9"	None specified	4"	4"	9" (TV)	None specified	4"	4"	9"	9"	4" (laptop), 9" (TV)	None specified	4"	None specified	4"	4"	7"

\* Manufacturer does not have to register, but devices are considered covered

Note: Further details on product scope can be found in Appendix A