

MOVING SUSTAINABLE ELECTRONICS FORWARD:

An Update to the National Strategy for
Electronics Stewardship

**Interagency Task Force on Electronics Stewardship
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White House Council on Environmental Quality
Environmental Protection Agency
General Services Administration*

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Executive Summary

Electronic devices and technologies continue to advance and increase in number. It is likely that our society will continue to incorporate these devices into our daily activities and that the number of electronic devices in our homes and offices will increase. Our growing reliance on electronics highlights the need to take a long-term sustainable approach towards electronics stewardship, both at work and at home. With the prevalence of electronics in mind, the federal government is committed to being a responsible consumer of electronics and a leader of electronics stewardship in the US.

Highlighting the progress accomplished on establishing a truly sustainable electronics stewardship strategy under the 2011 National Strategy for Electronics Stewardship (NSES), this report serves to increase the awareness of the importance of electronics stewardship and recognize the opportunities and challenges created by the exponential growth of electronics in the US. This report focuses on the major achievements under the NSES as of July 2014, as well as the impacts of improved electronics stewardship and the significance of upcoming commitments within the NSES.

This report is organized according to the goals established in the NSES:

1. Build Incentives for Design of Greener Electronics, and Enhance Science, Research and Technology Development in the United States;
2. Ensure that the Federal Government Leads By Example;
3. Increase Safe and Effective Management and Handling of Used Electronics in the United States; and,
4. Reduce Harm from US Exports of E-waste and Improve Safe Handling of Used Electronics in Developing Countries.

Under each goal, completed and upcoming key accomplishments are highlighted to demonstrate the variety of actions that have been and are being taken under the NSES to create a comprehensive strategy for electronics stewardship. While specific federal agencies are responsible for each action, most would not be accomplished without action by industry, non-governmental organizations (NGOs) or other stakeholders. Recent accomplishments range from the increased number of green design standards and electronics devices that meet them to the expanding the number of third-party certified recyclers and the increased amount and quality of used electronics export information. These initiatives have benefited the environment, public health, and the economy.

While this report focuses on the actions the federal government is taking, it also discusses how the NSES has proven to be a catalyst for other efforts, providing examples of complementary efforts that will lead to an even greater impact on the safe and effective management of used electronics in the US. As efforts under the NSES continue to progress, the benefits will continue to extend beyond the federal community, including a stronger recycling industry; improved recycling practices and worker safety; increased safe recycling options; and improved electronic devices for all electronics users.

The Rise of Electronics and a Call to Action

A look back at recent history reveals how quickly the electronics industry has grown, reinforcing the need for a collaborative, sustainable approach to electronics stewardship. While flat screen televisions, tablets, e-readers, and smart phones are part of everyday life for many Americans in 2014, the same cannot be said for Americans prior to 2000.

Around 2006, consumers were able to select devices based on technical attributes (e.g., faster, smarter) and energy efficiency ratings; however, it was difficult to select products with consideration to a broad range of environmental attributes (e.g., less toxic, easily upgraded or recycled). Even the federal government, a major purchaser of electronics, was limited in its ability to purchase greener electronics because only computers, laptops, and monitors were identified as being “green” under available tools.

In less than a decade, the electronics landscape evolved with a speed few could have predicted, outpacing the ability to appropriately manage these products and ensure that devices at the end of their useful life were being properly managed. Previously, used electronics were given to family or friends, tossed into the trash, or stored in closets, with only about a quarter of the used electronics being sent for recycling in 2009¹. The majority of unwanted electronics ended up in landfills, providing a lost opportunity to reuse or recover the valuable materials that make up electronics such as gold, silver, and copper.

As consumers and businesses increased their use of electronics, the media reported on US electronics being exported to developing nations where they were handled in unsafe ways that could cause harm to workers and communities. There was little data on US export quantities and destinations available for policy makers and stakeholders to consider. Meanwhile, federal agencies were independently working to address this data

Electronics Trends in the US

Sales of new electronic products are driving an increase in use, storage, and end-of-life management of electronics. EPA estimates that **438 million electronics** were sold in 2009, doubling sales from 1997, including a nine-fold increase in mobile device sales.

Electronics Waste Management in the United States through 2009, May 2011

Resource Conservation and Electronics

When products are reused and materials are recycled, we avoid the need to extract new raw materials. For every million cell phones recycled, we can recover:

35,274 pounds of copper

772 pounds of silver

75 pounds of gold and,

33 pounds of palladium.

Electronics Waste Management in the United States through 2009, May 2011

Improving Recycling Rates

In 2009, 25% of consumer electronics were collected for recycling. By 2011, 29% of consumer electronics were collected for recycling.

EPA Electronics Waste Management in the United States, July 2008 EPA 530-R-08-009 & EPA Municipal Solid Waste in the United States: 2011 Facts and Figures. May 2013

¹ US EPA Electronics Waste Management in the United States, July 2008 EPA 530-R-08-009

information gap and other electronics-related issues, but lacked the coordination needed to address these issues effectively and efficiently.

Consequently, on America Recycles Day in November 2010, President Barack Obama announced that the federal community would lead by example and establish a government task force “to prepare a national strategy for responsible electronics stewardship, including improvements to federal procedures for managing electronic products.” In July 2011, the taskforce released the [National Strategy for Electronics Stewardship](#) (“NSES” or “National Strategy”), establishing an innovative, flexible, pragmatic, and yet unified framework to evolve electronics stewardship. The actions identified in the NSES provide a roadmap to ensure that electronics are designed, purchased, and managed in a more sustainable manner, help protect human health and the environment from harmful effects associated with the unsafe handling and disposal of used electronics, and simultaneously promote new and innovative technologies of the future. The NSES also identifies the opportunities and benefits that improved management of used electronics could provide in terms of job creation, improving public health and the environment, minimizing waste, and maximizing recovery of materials. A comprehensive list of the NSES activities, [Agency Benchmarks to the Federal National Strategy for Electronics Stewardship](#), can be found on the [FedCenter Electronics Strategy website](#).

Serving as a catalyst for further action nationwide, the National Strategy brought the importance of approaching electronics stewardship from a lifecycle perspective - from designing and purchasing through recycling and disposing of the product - to the forefront. While the federal government can use its significant purchasing power and influence to start addressing these issues, all stakeholders involved in electronics stewardship must ultimately be part of the solution for the goals in the NSES to be achieved. Many private sector stakeholders, including retailers, electronics manufacturers, and distributors, and industry associations have embraced the NSES, contributing to the comprehensive effort to sustainably and responsibly design, purchase, and safely manage electronic products.

Goals and Key Accomplishments

Federal agencies have embraced the National Strategy and its goals by completing projects that make electronics purchasing, management, and disposal more efficient, cost-effective, and environmentally-friendly. This report highlights examples of specific accomplishments that are noteworthy under each of the four goals. It also identifies a number of actions that are expected to reach completion in the near future and describes how the NSES has complemented and strengthened efforts outside of the National Strategy’s scope.

Who Buys Green Electronics?

77% of all state and local governments are purchasing EPEAT® registered products.

National Association of State Procurement Officials Responsible Purchasing Trends, 2010, Page 13

Completion of the action items under each goal moves the federal government, and its partners and stakeholders, closer to providing a long-term approach to electronics stewardship and minimizing the negative environmental and human health impacts of electronics throughout the life of electronic devices. The following sections expand upon the broader vision for each goal and highlight some of the successes to date.

Certification: A Success across the Board for the NSES

Some key efforts within the National Strategy cross more than one goal, highlighting their importance. Encouraging certification of electronics recycling and refurbishment facilities is a key effort that crosses several goals in the NSES. The certification efforts under the NSES have helped to dramatically increase the number of certified refurbishers and recyclers since the release of the NSES. As collection and management of used electronics do not necessarily ensure sound recycling, the federal government has encouraged electronics refurbishing and recycling facilities to voluntarily become certified to standards that specify best practices. These standards help recyclers to effectively and safely recycle and manage electronics by having accredited, independent third-party auditors assess their ability to manage used electronics in an environmentally sound manner.

In 2011, approximately **100 facilities** had become certified under the newly established voluntary electronics recycling certification programs. As of mid-June 2014, more than **565 facilities** have obtained voluntary certification.

Goal 1: Build Incentives for Design of Greener Electronics, and Enhance Science, Research and Technology Development in the United States

Building greener electronics includes developing standards and conducting research that keep up with rapidly evolving technologies. The NSES actions support the development of “environmentally-friendly” product standards for electronics that contain fewer toxic materials, use less energy, last longer, use more recycled materials in the product and packaging, and are more easily recycled or upgraded.

The federal government plays a variety of roles in achieving this goal, including participating with stakeholders in developing voluntary standards and conducting research directly, or incentivizing academia, industry, and others to do so.

There are many research gaps that need to be filled with regard to electronics. Recent discussions with stakeholders are helping to identify these major research gaps, which can be addressed by initiating new research. The following highlights the NSES accomplishments in the area of green electronics and research.

Stronger Efforts to Purchase Greener Electronic Products: Federal agencies (the Environmental Protection Agency (EPA), Department of Energy, Department of Education, General Services Administration (GSA), and the Department of Agriculture), other national governments, original

electronics manufacturers, recyclers, non-government organizations, academics, suppliers, and potential purchasers have joined together to be actively engaged in a multi-stakeholder process to develop environmentally preferable, or “greener,” electronics standards for desktop computers, laptops, monitors, televisions, printers, copiers, fax machines, and other electronic devices. These voluntary standards, which are developed in an open and consensus-driven fashion, create the structure of the [Electronic Product Environmental Assessment Tool](#) (EPEAT). EPEAT® is an independent rating system that identifies greener electronic products that meet multiple environmental standards. EPEAT®-registered products contain fewer toxic materials, use less energy, last longer, use more recycled materials in the product and packaging, and are more easily recycled or upgraded than other electronics.

Benefits from EPEAT®-Registered Products

In 2012, more than 114 million EPEAT registered products were sold around the world. Over their lifetime, these devices will reduce enough:

- Energy to power nearly 1 million US homes for a year.
- GHG emissions to equal removing 1.5 million passenger cars from the road for a year.
- Solid waste to equal the trash that 78,000 US households produce.
- Hazardous waste to equal the weight of 13 Empire State buildings.

<http://www.epeat.net/about-epeat/environmental-benefits/>

With the backing of the NSES, new voluntary standards for televisions and imaging equipment (e.g., scanners, copiers, and printers) have been created and added to EPEAT®’s rating tool. Today, purchasers around the world can easily find thousands of electronic products rated at EPEAT® bronze, silver, or gold levels. Since the release of the NSES, new work has begun on developing voluntary environmental performance standards for servers and cell phones. Federal agencies are actively engaged in this process and lending their expertise to these discussions.

Federal purchasers are currently required to buy EPEAT registered products, and the EPA has trained federal purchasers on how to buy these greener products with great success. In 2012, 80 percent of reporting agencies met the 95 percent threshold for EPEAT® registered purchases², contributing to reduced negative public health and environmental impacts. The EPA launched the [greener products website](#) to help purchasers find greener products, including greener electronics.

This work has impacted domestic and international electronics procurement. Purchasers of EPEAT® products are located in 43 countries and include the governments of eight countries. In addition, state and local governments, large corporations, and businesses are purchasing electronics that meet these green design standards.

² Agencies 2013 Strategic Sustainability Performance Plans.

Research on Worker Exposure in Recycling Facilities: The Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH), and the EPA are researching potential worker exposures to harmful materials at electronics recycling facilities. NIOSH has completed [exposure evaluations](#) at several electronics recycling facilities, and conducted a pilot survey of several electronics recycling facilities across the US. Through this and other work, NIOSH has determined that workers in facilities that process cathode ray tube (CRT) glass, including workers in areas outside of where the glass is processed who may not be aware of possible exposures, may be overexposed to lead and could track lead dust to other parts of the facility and to their vehicles and homes. This important work has been shared with the electronics recycling industry and has helped to inform the electronics recycling certification programs, *The Responsible Recycling (“R2”) Standard for Electronics Recyclers (R2)* and *e-Stewards® Standard for Responsible Recycling and Reuse of Electronic Equipment (e-Stewards®)*, of this possible concern and to promote awareness in the electronics recycling industry through accompanying guidance.

Looking Forward - Below are some of the actions under Goal 1 that are expected to reach completion in the near future:

Research on Rare Earth Elements: Electronic products are increasingly dependent upon rare earth elements (REEs), making recovery of these materials during recycling crucial for their long-term availability. When contained in scrap electronics, REEs are often difficult to recover because of their presence in minute amounts in the electronic device and the larger electronics waste stream. The EPA has awarded a Small Business Innovation Research (SBIR) contract in two phases for recovering REEs from electronics scrap.

A contract for the first research phase, [Automated Identification and Sorting of Rare Earth Elements in an E-Waste Recycling System](#), was issued to find an easy, efficient, and automated way to separate and collect the parts of electronic scrap that contain REEs. This contract was completed and a second contract for the last phase of the research was awarded.

Research Coordination

EPA’s Office of Research and Development held a Sustainable Electronics Forum in 2012, resulting in the development of a research roadmap that can serve to guide EPA and other stakeholders in prioritizing electronics-related research.

<http://nepis.epa.gov/Adobe/PDF/P100ISC9.pdf>

New Recycler Survey

On June 11, 2014, the National Institute for Occupational Safety and Health released the results of a new survey “*A Pilot Assessment of Occupational Health Hazards in the US Electronic Scrap Recycling Industry*”. The survey showed that electronics recycling has the potential for a wide variety of occupational exposures and that educating the industry about adequate health and safety practices could help protect employee health.

http://www.cdc.gov/niosh/hhe/reports/pdfs/e-scrap_survey_report.pdf

Evolving Technology

Semiconductors are components found in electronics products. Semiconductors made in the 1980’s required the use of 12 elements; today, they are made with up to 60 different elements.

Theis 2007, Prof. Armin Reiter - Increasing Material Variety in Semiconductor Industry

The second phase of the research, [Cost-effective Rare Earth Element Recycling Process from Industrial Scrap and Discarded Electronic Products to Valuable Magnetic Alloys and Permanent Magnets](#), is targeted for completion in July 2015. The expectations for this research include the development of an efficient, yet low cost method to recycle REEs from industrial and electronics scrap and the ability to manufacture the REEs into valuable magnetic alloys and high-performance magnets.

Increased Availability of Greener Electronics: As a source of products and services to other agencies, GSA is working to increase the availability of energy efficient and environmentally preferable electronics. Through GSA Advantage, agencies can find more than 25,000 Energy Star products and more than 5,300 EPEAT®-registered products. For imaging equipment and appliances, GSA offers only Energy Star® certified products for federal procurement. For computers, GSA offers Energy Star® and non-Energy Star® products, and EPEAT®-registered products.

Recycling of Liquid Crystal Displays (LCD)

Research from EPA's People, Prosperity & Planet (P3) student competition: Recycling LCD screens that are used in TVs and computers is expensive and complicated. Students from Purdue University developed new tools and green processes for dismantling LCDs to recover mercury for proper management and high-value material for reuse – making LCD recycling profitable in the US.

<http://cfpub.epa.gov/ncer/abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/9847/report/0>

Goal 2: Ensure that the Federal Government Leads By Example

Collectively, the Federal Government is one of the largest consumers of information technology goods and services in the world. By fulfilling commitments in the National Strategy, the Federal Government is becoming one of the most responsible purchasers of information technology goods and services, and more specifically, of electronic devices. Currently, federal agencies are required to purchase EPEAT®-registered products for at least 95 percent of electronic product acquisitions, unless there is no EPEAT® standard for the product³. There was not, however, a corresponding requirement on how to recycle used federal equipment until recently. Today, guidelines are available and regulations are in development (see section titled *Government-Wide Policy on Managing Used Electronics*).

Federal Spending on Electronics

In 2012, the federal government spent approximately \$82 billion on purchasing, supporting, and recycling electronics products

OMB Office of E-Government and Information Technology
<http://www.whitehouse.gov/omb/e-gov/>

Recent accomplishments under this goal demonstrate how the federal government is moving toward managing used electronics uniformly across all agencies. Prior to the NSES, GSA's government-wide policies encouraged continued use and reuse of used electronics no longer needed by the agencies. However, apart from requiring

³ Under Executive Order 13423 "Strengthening Federal Environmental, Energy, and Transportation Management" and Executive Order 13514 "Federal Leadership in Environmental, Energy and Economic Performance."

agencies to follow state or local laws, the Federal Government did not encourage the use of certified recyclers and refurbishers. Standard practices included sending the used equipment to other federal facilities; donating the equipment to schools or state and local organizations; or selling the used equipment through public auctions. Greater awareness of potential disposal problems and opportunities to improve efficiency and materials recovery led to the drafting of a new federal policy for improved and uniform management of used electronics.

With the consolidation of federal data centers and key innovations, such as server virtualization⁴ and virtual desktop and cloud computing⁵, how the Federal Government uses electronics will continue to evolve. These changes could greatly reduce the amount and type of hardware needed. Purchasing less equipment would result in less information technology support and maintenance costs, with the added benefit of less electronic waste that the Federal Government must manage.

The following are examples of the most significant accomplishments with regard to management of used, federally-owned electronics:

Government-Wide Policy on Managing Used Electronics: In 2011, GSA issued a Bulletin ([Federal Management Regulation \(FMR\) Bulletin-B34](#)) to all federal agencies that provides guidance on the management of federal used electronics, including the use of certified recyclers by federal agencies and the tracking of used electronics through the use of a GSA tool due to be completed in the near future. On March 6, 2014, GSA published a Proposed Rule, [Disposal and Reporting of Federal Electronics Assets \(FMR 102-36\)](#)⁶, that requires federal agencies to use the government-wide guidance published in FMR Bulletin B-34. GSA received a wide range of comments from the public and private sectors and is working towards publishing a final rule.

Expanding Federal Purchasing Rules

On June 24, 2014, the Department of Defense, GSA, and National Aeronautics & Space Administration issued an interim rule amending the Federal Acquisition Regulation (FAR). This interim rule expands the available products federal purchasers should procure that are on the Electronic Product Environmental Assessment Tool (EPEAT®) registry beyond personal computer products to include imaging equipment (i.e., copiers, digital duplicators, facsimile machines, mailing machines, multifunction devices, printers, and scanners) and televisions.

Federal Register Notice, Federal Acquisition Regulation: EPEAT Items - [FAR Case 2013-16; Item 1](#)

⁴ Server virtualization refers to a practice of consolidating server space so multiple applications can take place on one server as opposed to many, thereby reducing the need for hardware and excess physical space for the servers.

⁵ Virtual desktop and cloud computing refers to a system by which many computers from different physical locations can access the same software or data located remotely on a server that serves as “the cloud”. This allows anyone with a computer anywhere in the world to access their information without having it physically on their computer.

⁶ Proposed Rule *Disposal and Reporting of Federal Electronics Assets (FMR 102-36)* can be found at: www.regulations.gov/#!documentDetail;D=GSA_FRDOC_0001-0959, www.federalregister.gov/articles/2014/04/09/2014-07903/federal-management-regulation-disposal-and-reporting-of-federal-electronic-assets-fea, and www.gsa.gov/electronics

Building Tools for Reusing Used Electronics: GSA’s *Agency Asset Management System (AAMS)* allows federal agencies to easily transfer used electronics within their own agencies – before the used electronics are offered to other agencies. This tool improves information sharing on used electronics and increases the reuse of the equipment within agencies.

USPS BlueEarth® Federal Recycling Program: This program is available to participating federal agencies and their employees to send qualified used electronics to a certified electronics recycler with no shipping cost to the agency.

Electronic devices covered under the [*USPS BlueEarth® Federal Recycling Program*](#) include: ink and toner cartridges, cell phones, tablets, personal computer towers, servers, and other small electronics. This program is designed to supplement existing federal agency asset management and recycling programs and includes providing recycling activity reports to assist in meeting federal reporting obligations. The US Postal Service (USPS) has a unique ability to touch every federal agency in most every location throughout the US. This program allows USPS to provide federal agencies and their employees’ transportation of qualified used electronics at no cost to the agency or employee. This program is particularly helpful in transporting used electronics for recycling to a certified electronics recycler from federal facilities located in remote locations.

BlueEarth® Federal Recycling: Participating Agencies

- Bureau of Alcohol, Tobacco, Firearms and Explosives
- Department of Agriculture
- Department of Commerce
- Department of Defense
- Department of Energy
- Department of Homeland Security
- Department of Housing and Urban Affairs
- Department of the Interior
- Department of Transportation
- Environmental Protection Agency
- Federal Aviation Administration
- Federal Energy Regulatory Commission
- General Services Administration
- Nuclear Regulatory Commission
- Small Business Administration
- United States Postal Service

Looking Forward – Below are some of the actions under Goal 2 that are expected to reach completion in the near future:

Informing the Public of Preferable Recycling Options: As part of GSA’s new policy, when used electronic products leave federal ownership, the equipment will include documentation to inform the recipients how they should be managed at the end of their useful life (e.g. using certified recyclers). Training will be presented to federal customers, as well as other interested customers and stakeholders.

Identifying Criteria for Electronics Certification Programs: There are two electronics recycling certification programs, R2 and e-Stewards®, that are widely used by electronics refurbishers and recyclers in the US. GSA recognizes that refurbishers and recyclers may want to use other existing certification programs or that new certification programs may be developed in the future. Consequently, GSA, in consultation with other federal agencies, is developing criteria to evaluate and determine which standards refurbishers and recyclers are to use if they want to manage the Federal Government’s used electronics. The EPA is developing a draft set of criteria to address the *environmental* aspects of

electronics reuse and recycling while other agencies will address issues such as worker health and safety and data security. GSA requested [public comment](#) on what aspects should be considered in the criteria. Once completed, GSA will make these criteria publicly available.

Studying Electronics Recycling Certification Programs: Under the NSES, the EPA committed to study – in partnership with GSA and the ANSI-ASQ National Accreditation Board (ANAB) – the implementation of two electronics recycling certification programs currently used in the US (R2 and e-Stewards®) in order to determine whether the standards are implemented transparently and consistently and are achieving the desired results. The study consists of (1) interviewing key stakeholders in the electronics recycling process; (2) observing audits of electronics recycling facilities as they are performed by the different registrars (or certifying bodies) and/or witnessed by ANAB, and (3) developing a final report documenting the findings and any recommendations for improvement. The study is on track for completion by fall 2014.

Goal 3: Increase Safe and Effective Management and Handling of Used Electronics in the United States

American households continue to buy and use electronics in increasing numbers, as the function and form of electronics used by consumers rapidly evolve. Today, the average US household has between 20-30 electronics devices.⁷ With the increase of electronics purchased, there is a corresponding increase in electronics discarded. Recent reports show that the amount of used electronics collected for reuse and recycling continues to increase⁸, however, there is still room for further improvement.

In an ideal world, every unwanted device would be collected, triaged for potential reuse, repair, or refurbishment, and if deemed unusable, recycled in an environmentally sound way, making the most use of each component, including the precious metals, plastics, metal casings, and glass. Though the ideal has not yet been achieved under the NSES, management of used electronics is certainly moving in the right direction.

Urban Mining

One metric ton of circuit boards can contain 40 to 800 times the amount of gold and 30 to 40 times the amount of copper compared to one metric ton of virgin ore mined or extracted in the US.

US Geological Survey: Recycled Cell Phones - A Treasure Trove of Valuable Metal, 2006

Developing electronics recycling standards that are used by certification programs requires input by a wide range of stakeholders, such as governments, original electronics manufacturers, refurbishers and recyclers, non-governmental organizations, vendors, and customers. Certification provides the Federal Government and the American public with a level of confidence that their used electronics will be managed effectively and safely in accordance with the voluntary standards. New tools are now available to aid consumers, businesses and governments to easily find certified electronics recycling facilities when needed.

⁷ Consumer Electronics Association, 15th Annual CE Ownership and Market Potential Study. April 2013.

⁸ US EPA, Municipal Solid Waste in the United States: 2011 Facts and Figures. May 2013

Worker safety is a major concern in the electronics recycling industry and it is important to ensure that recycling is not causing negative effects on human health. Worker health and safety information that describes best practices at electronics recycling facilities is being gathered and shared with the electronics recycling industry. In addition to the NIOSH research previously discussed in Goal 1, health and safety information regarding managing and processing used electronics has been gathered and made publicly available (see *Green Jobs and Hazards Website* section on page 15).

The following examples highlight the most significant accomplishments that have occurred in the US under this goal:

Sustainable Materials Management (SMM) Electronics Challenge: On September 22, 2012, the EPA launched the [SMM Electronics Challenge](#), where electronics manufacturers and retailers commit to: sending 100% of the used electronics they collect from the public, businesses, and within their own organizations to certified electronics refurbishers and recyclers; offering electronics collection programs that use R2 and e-Stewards® certified recyclers to the public; increasing the amount of used electronics collected and recycled; and posting public information on collection programs and recycling data.

In developing the Challenge, the EPA received valuable input from a number of stakeholders, including original electronics manufacturers, electronics retailers, non-governmental organizations, and states.

To recognize exceptional leadership and innovation throughout the electronics lifecycle, participants are eligible to apply for SMM Electronics Challenge Champion Awards. Consumers and businesses alike are benefitting from the SMM Electronics Challenge and the work of the participating companies, as everyone can take advantage of the collection points participants have established for responsible electronics recycling.

Electronics Challenge Participants

- Best Buy Company
- Dell, Inc.
- LG Electronics USA, Inc.
- Nokia Corporation
- Panasonic Corporation
- Samsung Electronics Company
- Sony Electronics, Inc.
- Sprint Nextel Corporation
- Staples, Inc.

World Map of Certified Recyclers: The quick adoption of certification by the electronics refurbishing and recycling industry demonstrates that the private sector is supportive of improving electronics stewardship and sees it as an opportunity for business growth. Over the last few years, the US has experienced an increase of more than 360 percent in the number of electronics refurbishers and recyclers that have become certified to the e-Stewards® and R2 standards since the release of the National Strategy in 2011. As of the publication of this report, more than 565 electronics refurbishing and recycling facilities have become certified to at least one of these standards. Refurbishers and recyclers certified to these standards can now be found in 45 US states and 16 countries.

To make it easier to find locations of certified recycling facilities, EPA developed an interactive [map of certified refurbishers and recyclers](#). The map consolidates information obtained from the e-Stewards®

and R2 certification programs and identifies where electronics recyclers certified to these two standards can be found both in the United States and across the globe.



Green Jobs and Hazards Website: The Occupational Safety and Health Administration (OSHA) developed the [Green Jobs and Hazards](#) website to raise awareness of the many processes, technologies, and potential dangers that can be experienced during electronics recycling. The web page also addresses the potential hazards from specific components found in electronics, such as: ammonia, polychlorinated biphenyls (PCBs), lead, mercury, asbestos, refractory ceramic fibers, and radioactive substances.

Looking Forward - The following project under Goal 3 is expected to reach completion in the near future:

Guidance on Worker Safety: OSHA is developing a guidance document on worker health and safety that is specific to the electronics recycling industry. This guidance is expected by the end of 2014.

Goal 4: Reduce Harm from US Exports of E-waste and Improve Safe Handling of Used Electronics in Developing Countries

Electronic stewardship is a global effort that requires collaboration and partnerships with other countries and international organizations in order to minimize the problems and maximize the opportunities. The release of the NSES opened the door for a more concerted, collaborative approach to addressing the high-profile and often controversial issues related to used electronics and e-waste flows from the US. The National Strategy has also proven to be an opportunity to show a commitment to building global capacity for used electronics management, whether it be domestically generated or imported from other countries. With little, if any, reliable data on US export quantities and destinations available, the federal government is committed to improving information about US exports. At the same time, federal agencies are collaborating with key countries to assess their needs and to better understand the flows and amounts of e-waste, so that capacity-building efforts can be effectively targeted.

Federal agencies are partnering with other governments and international organizations to share best practices and train electronics recycling workers, and to leverage resources for scaling up an electronics recycling facility. Some of the most recent accomplishments are described in more detail below.

New Reports on US Exports of Used Electronics: In 2013, both the US International Trade Commission (USITC) and the United Nations University StEP (Solving the E-waste Problem) Initiative issued reports on US exports of used electronics.

At the request of the US Trade Representative, the USITC, an independent, fact-finding federal agency, issued the report [*“Used Electronic Products: An Examination of U.S. Exports”*](#) on March 8, 2013. The report⁹ provides estimates of US exports of used electronics in 2011, information on the characteristics of exported used electronics, information on the types of US enterprises that export used electronics and foreign enterprises that import used electronics from the US, and end uses of US used electronics exports. The report also examines factors that affect trade in used electronics.

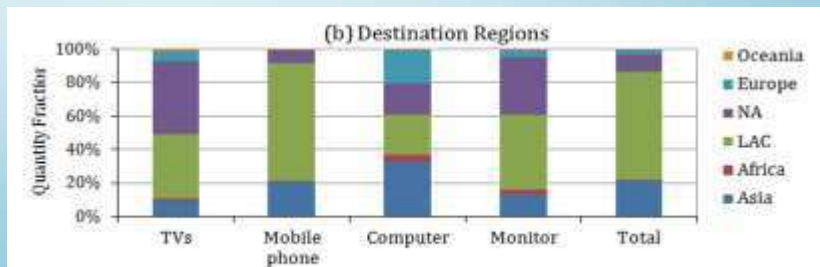
Domestic & International Sales

U.S. organizations reported \$20.6 billion in total sales of used electronics in 2011, composed of \$19.2 billion of domestic sales and U.S. exports totaling \$1.45 billion, or 7 percent of total sales.

US International Trade Commission ‘Used Electronic Products: an Examination of U.S. Exports’, March 2013

The StEP report, [*“Quantitative Characterization of Domestic and Transboundary Flows of Used Electronics: Analysis of Generation, Collection, and Export in the United States.”*](#) was completed in conjunction with the Massachusetts Institute of Technology (MIT) and the National Center for Electronics Recycling (NCER), and funded by EPA.

Destination of US Exports



Quantitative Characterization of Domestic and Transboundary Flows of Used Electronics: Analysis of Generation, Collection, and Export in the United States, February 2013, Figure 30, chart (b).

This report provides estimates of US exports of used electronics in 2010 and found that, based on the existing trade data, 8.5 percent of materials collected were exported. It also describes the challenges to getting an accurate assessment of exports due to various factors, including: not having specific trade codes for new and used electronics; the large number of trade codes that could be used to categorize electronics; and the lack of consistent definitions for labeling used electronics (i.e., for reuse or recycling).

⁹ The data in this report are largely based on the compilation and statistical analysis of primary data collected from responses by US organizations to the Commission’s questionnaire. This quantitative analysis is augmented by confidential, firm-level export data provided by Census and by qualitative information developed through a public hearing, written submissions, literature review, industry interviews, and site visits to US processors and handlers of used electronics.

Both studies offer novel, in-depth, research-based analysis of US exports of used electronics. These reports provide a foundation for growing the knowledge base on US exports of used electronics.

Building a Picture of Global Flows of E-waste: In 2013, StEP launched the [E-Waste World Map](#), providing country-level data on the amounts of electronics on the market and the volumes of e-waste generated. The EPA provided financial support to this project in an effort to shed more light on global e-waste flows to assist global discussion. This web-based map will expand over time, as more information on transboundary flows of used electronics is collected, analyzed, and incorporated in the map.

Building Capacity for Sustainable Management of Used Electronics in North America: Under the auspices of the North American Commission for Environmental Cooperation, the federal environmental agencies in the US, Canada, and Mexico worked together to develop [training sessions on environmentally sound management](#) at electronics refurbishing and recycling facilities in North America. The training sessions were well attended and drew over 120 interested recyclers in Mexico and Canada during the summer of 2013. The training sessions were developed in modules and covered topics such as: environmentally sound management for workers and managers; risk assessments and risk prevention; and legal compliance and recordkeeping.

Building Capacity for Sustainable Management of Used Electronics in Africa: Over a decade ago, the Ethiopian Government identified a lack of electronics recycling capacity in Ethiopia and decided to use part of a World Bank loan to increase its capacity. The EPA partnered with StEP to assess the capacity of an existing Ethiopian refurbishment and recycling facility in Addis Ababa to manage used electronics in an environmentally sound manner. As a result of that work, Ethiopia was able to use the results of this assessment to obtain \$1 million from the Global Environment Facility (GEF) to scale-up recycling efforts. A consortium originally established by StEP and now managed by the Ethiopian Government and the United Nations Industrial Development Organization with GEF support, oversees this project that runs through 2015.

Improving Information Exchange on Used Electronics: Through structured and informed discussions on electronics stewardship, countries in the Asia-Pacific Economic Cooperation (APEC) forum have increased understanding of the economic, environmental, and social impacts of trade in used electronics; the role of trade in used electronics in supply chains; and the steps that can be taken to help ensure environmentally sound management of used electronics. The International E-waste Management Network (IEMN) organized by the EPA and the Environmental Protection Administration Taiwan enables environmental officials to directly exchange best practices related to e-waste management. This group has met annually since 2011 and includes participants from the Asia-Pacific, African, Latin American, and Caribbean regions.

Revisions to Cathode Ray Tube Regulation: On June 26, 2014, the EPA published a revision to the cathode ray tube (CRT) regulations that improves requirements for exports of CRTs for reuse and

recycling. The revisions allow the EPA to better track exports of CRTs for reuse and recycling by requiring CRT exporters to provide additional information to EPA and by clearly defining the term “CRT exporter.” These amendments will help ensure safe management of CRTs. The citation in the Federal Register is **79 FR 36620, June 26, 2014**.

Basel Convention: Since the National Strategy was released, the Federal Government has continued to participate in efforts to exchange information and provide best practices under the auspices of the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal*. Recently, the Federal Government was an active participant in the development of the 2013 *Framework for the Environmentally Sound Management of Hazardous Wastes and Other Wastes*, which is a technical guidance document, intended to provide a common understanding of, and strategies for, the implementation of environmentally sound management of wastes that are subject to the Basel Convention, which includes some e-wastes. Additionally, the Federal Government presented information on the US approach to e-waste through a number of Basel Convention webinars intended to exchange information on how countries currently manage e-waste. With 181 Parties to the Basel Convention, it presents an excellent forum for global exchange. While the United States is With 181 Party governments to the Basel Convention, it presents an excellent forum for global exchange. While the United States is a signatory and not yet a Party to the Convention, the Federal Government participates in its meetings as the Basel Convention helps to protect human health and the environment against the adverse effects of hazardous wastes, a long-supported US goal.

Looking Forward: – Within Goal 4 of the National Strategy, the following is an effort expected to reach completion in the near future:

Trade Flows of Electronics from North America: The three countries (United States, Canada, and Mexico) that make up the Commission of Environmental Cooperation for North America are studying North American trade flows of used electronics. This work is expected to be complete in late 2014.

[Complementary Electronics Efforts](#)

While the NSES provides a general framework for prioritizing work with respect to electronics stewardship, it was not considered the “end-of-the-road” with regard to electronic stewardship, and therefore was developed to be flexible and broad enough to encompass additional work that emerges over time. Currently, additional activities are underway that were not specifically identified in the 2011 *NSES Benchmark*. Some of this work is a natural outcome from the actions identified under the National Strategy, while other work was done independently by stakeholders. The following is not a comprehensive list, but provides examples that have come to the attention of the NSES taskforce.

US-Mexico Webinars on Electronics Recycling Certification: The Border 2020 Program, a joint effort between the US and Mexico, hosted two Electronics Recycling Certification webinars (late 2013 and early 2014) to introduce electronics recyclers located on the US-Mexican border to the [R2](#) and [e-](#)

[Stewards®](#) electronics recycling certification programs. The webinars were presented in Spanish and drew over 150 participants representing government, business, academia, and community-based non-profits. The webinars also drew participants from Mexico City, Honduras, and El Salvador.

Raising Awareness about Electronics Recycling: One of the largest challenges to increasing the US's electronics recycling rate is communicating to the American consumer the importance and ease of recycling used and unwanted electronics in the United States. To help overcome this challenge, two electronics stakeholders have independently begun to fill the communication and outreach gap.

The Consumer Electronics Association (a trade association for electronics manufacturers), developed and released [public service announcements](#) (PSAs) on recycling used electronics and where they can be dropped off for recycling. These PSAs were developed for television and radio.

The Institute of Scrap Recycling Industries (a trade association for recyclers including electronics recyclers), and *The Jason Project* (a nonprofit organization managed by Sea Research Foundation, Inc., in partnership with the National Geographic Society), worked together to develop [school-aged curriculum](#) to help teachers and students understand both the importance of recycling and the recycling industry. This work includes bringing the electronics recycling message to teachers and school children in elementary through secondary school.

Stakeholders Collaborate on CRT Recycling Issues: Over the past decade, advancements in flat panel technology for computer monitors and TVs have phased out monitors and screens made with cathode ray tubes (CRTs). As a result, the recycling market for used CRTs has changed dramatically and has led to growing problems related to the accumulation and potential abandonment of CRTs, which could lead to the release of hazardous constituents, such as lead, to the environment.

In response to these concerns, a variety of stakeholders - regulators, non-governmental organizations and industry alike – have taken action. Stakeholders have collected data and initiated multi-stakeholder dialogues to investigate the extent of the problem and have hosted challenges to find and showcase new uses or recycling technologies for CRT glass. Additionally, other stakeholders have invested in developing new recycling technologies to manage the increasing amount of CRT glass. The EPA hosted a public webinar on the issue, drawing 400 participants from industry, states, and the environmental community, and issued a set of [Frequently Asked Questions](#) on the federal regulations that apply to used CRTs and CRT glass, including information about proper storage of these materials. This issue is still evolving and will involve continued collaboration and public outreach to properly manage used CRTs.

Federal Regulation of CRTs (40 CFR 261.4(a)(22))

Used CRTs and CRT glass are not hazardous wastes under the Resource Conservation and Recovery Act (RCRA), provided that the following conditions are met:

Used CRTs and CRT glass are:

- Not incinerated or landfilled
- Not speculative accumulated (i.e., at least 75% of the material is recycled in a calendar year)
- Properly stored and labeled
- Exported for recycling only after providing notice and receiving consent
- Processed in buildings and are not subjected to temperatures high enough to volatilize lead

CRT glass is:

- Sent for recycling to a CRT glass manufacturer or lead smelting
- Not used in recycled products that are applied to or placed on the land unless they comply with certain hazardous constituent limits

Enforcement Actions Regarding Used Electronics: INTERPOL's Environmental Crime Program launched Operation Enigma in 2012, with the EPA's assistance, to identify and disrupt the illegal collection, recycling, export, import, and shipping of e-waste. The first phase targeted Europe and Africa, leading to the seizure of 240 tons of illegally-traded e-waste and the launch of criminal investigations against more than 40 companies.

Additionally, the EPA successfully prosecuted two cases involving the illegal export of CRTs.

- In October 2012, Discount Computers Inc. (DCI) and its owner pled guilty to trafficking in counterfeit goods and services and violating environmental laws relating to the illegal export of CRTs. This was the first e-waste conviction in the US. In March 2013, DCI was sentenced to pay a \$2 million fine and \$10,839 in restitution. In addition, the owner received 30 months incarceration, two years of supervised release, and a \$10,000 fine.

Enforcement: CRT Stockpiling

On October 12, 2012, EPA Region 2 entered into a consent agreement/final order with Supreme Asset Management and Recovery, Inc. to remove and properly dispose of approximately 5.8 million pounds of crushed cathode ray tube (CRT) glass on-site. The facility received and/or purchased spent and intact CRT computer monitors and spent and intact televisions and crushed the glass components and failed to make proper hazardous waste determinations in violation of the Resource Conservation and Recovery Act (RCRA). The company paid a \$5,000 civil penalty and was ordered to properly dispose of all crushed glass.

- In December 2012, Executive Recycling Inc. and its owner were convicted on multiple US criminal violations, including mail and wire fraud, smuggling, one count of failure to file notification of intent to export hazardous waste, and one count of exportation contrary to law. The company and its executives were sentenced for fraud because they claimed that they safely recycled e-wastes in the US, but in fact they were exporting obsolete and discarded equipment to developing nations. In July 2013, the company was sentenced to 36 months of probation and ordered to pay \$4.5 million in federal fines. The owner was sentenced to 30 months of incarceration, ordered to pay a \$7,500 federal fine, \$70,144 in restitution, and forfeit \$142,241.

Evolving and Expanding Electronics Stewardship

Successful collaboration among all levels of government, the electronics industry, non-governmental organizations, and other stakeholders has dramatically altered electronics stewardship in the United States in a short period of time. Companies are evolving technologies to meet consumers' needs while improving electronics design and manufacturing to minimize environmental impacts. Consumers have a better understanding of how electronics need to be properly managed, and more are choosing to purchase "greener" products and recycle discarded electronics. Other organizations are bringing awareness to the challenges that are faced in managing our electronics, as well as providing solutions.

The Federal Government has met President Obama's charge to create the National Strategy. The accomplishments highlighted in this report demonstrate that a momentum for change exists. The accomplishments achieved, as well as those upcoming undertakings within each goal, demonstrate how progress under the NSES has been achieved and will continue in the future. In addition, the complementary efforts of the government, electronics industry, NGOs, and other stakeholders demonstrate that sustainable electronic stewardship is a truly global conversation that goes beyond the National Strategy.

To maintain and enhance the benefits already achieved in electronics stewardship, continued participation is needed from all of us: governments, businesses, and consumers worldwide. A truly sustainable approach is an opportunity to protect human health and the environment, invest in our economic development and create jobs, and preserve valuable resources to be enjoyed by generations to come. As long as our daily lives require the use of electronics, there will continue to be a need for a sustainable approach to electronics stewardship.

Abbreviations:

AAMS	GSA's Agency Asset Management System
ANAB	ANSI-ASQ National Accreditation Board
APEC	Asia-Pacific Economic Cooperation
CEC	Commission for Environmental Cooperation of North America
CEQ	White House Council on Environmental Quality
CRT	Cathode ray tube
DCI	Discount Computers Inc.
DOL	Department of Labor
EO	Executive Order
EPA	Environmental Protection Agency
EPEAT®	Electronic Product Environmental Assessment Tool
e-Stewards®	Standard for Responsible Recycling and Reuse of Electronic Equipment
FMR	Federal Management Regulation
GEF	Global Environment Facility
GSA	General Services Administration
IEMN	International E-waste Management Network
LCD	Liquid Crystal Displays
MIT	Massachusetts Institute of Technology
NASA	National Aeronautics and Space Administration
NCER	National Center for Electronics Recycling
NIOSH	National Institute for Occupational Safety and Health
NGOs	Non-governmental organizations

NSES	National Strategy for Electronics Stewardship
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated biphenyls P3
	People, Prosperity & Planet
PSA	Public service announcements
REE	Rare earth elements
R2	Responsible Recycling (“R2”) Standard for Electronics Recyclers
RCRA	Resource Conservation and Recovery Act
StEP	Solving the E-waste Problem
SBIR	Small Business Innovation Research
SMM	Sustainable Materials Management
UN	United Nations
US	United States of America
USITC	US International Trade Commission
USPS	US Postal Service

Resources by Section:

The Rise of Electronics and a Call to Action

- *National Strategy for Electronics Stewardship* can be found at: <http://www.epa.gov/epawaste/consERVE/materials/ECYCLING/taskforce/docs/strategy.pdf>
- *Agency Benchmarks to the Federal National Strategy for Electronics Stewardship* can be found at: <https://www.fedcenter.gov/Documents/index.cfm?id=22223>

Goal 1:

- *Electronic Product Environmental Assessment Tool (EPEAT®)* can be found at: <http://www.epeat.net/>
- Greener Products website can be found at: <http://www.epa.gov/greenerproducts/index.html>
- CDC Research on Worker Exposure in Recycling Facilities can be found at: <http://www.cdc.gov/niosh/hhe/reports/pdfs/2012-0100-3217.pdf>
- CDC Worker Exposure Electronics Recycling Facility Pilot survey can be found at: http://www.cdc.gov/niosh/hhe/reports/pdfs/e-scrap_survey_report.pdf
- *Automated Identification and Sorting of Rare Earth Elements in an E-Waste Recycling System* can be found at: http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/10019/report/0
- *Cost-effective Rare Earth Element Recycling Process from Industrial Scrap and Discarded Electronic Products to Valuable Magnetic Alloys and Permanent Magnets* can be found at: http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/10032/report/0
- *Environmental Benefits of EPEAT® Registered Products* were calculated using the Electronics Environmental Benefits Tool that can be found at: <http://www.epeat.net/about-epeat/environmental-benefits/>

Goal 2:

- *Federal Management Regulation B-34* can be found at: http://gsaxcess.gov/hm/SCREEN/FMR_Bulletin_B-34.pdf
- Proposed Rule *Disposal and Reporting of Federal Electronics Assets (FMR 102-36)* can be found at: www.regulations.gov/#!documentDetail;D=GSA_FRDOC_0001-0959, www.federalregister.gov/articles/2014/04/09/2014-07903/federal-management-regulation-disposal-and-reporting-of-federal-electronic-assets-fea, and www.gsa.gov/electronics
- Interim Rule *Federal Acquisition Regulation: EPEAT® Items - FAR Case 2013-16; Item 1* <https://www.federalregister.gov/articles/2014/06/24/2014-14376/fac-2005-75-far-case-2013-016-item-i-docket-2013-0016-sequence-1-federal-acquisition-regulation>
- US Postal Service BlueEarth® Federal Recycling program can be found at: <http://blueearth.usps.gov/>

Goal 3:

- *SMM Electronics Challenge* can be found at: www.epa.gov/waste/consERVE/smm/electronics/index.htm
- EPA's Electronics Donation and Recycling webpage can be found at: <http://www.epa.gov/epawaste/consERVE/materials/ECYCLING/donate.htm>

- EPA's map of certified refurbishers and recyclers can be found at: www.epa.gov/epawaste/conserva/materials/ecycling/certmap.htm
- OSHA's green jobs hazards website for consumer electronics website can be found at: www.osha.gov/SLTC/recycling/recycling_consumer_electronics.html

Goal 4:

- *Used Electronic Products: An Examination of U.S. Exports* can be found at: www.usitc.gov/press_room/news_release/2013/er0308111.htm
- *Quantitative Characterization of Domestic and Transboundary Flows of Used Electronics: Analysis of Generation, Collection, and Export in the United States* can be found at: <http://epa.gov/international/toxics/ewaste/index.html>
- E-Waste World Map can be found at: <http://www.step-initiative.org/index.php/WorldMap.html>
- CEC Training modules on Environmentally Sound Management at electronics recyclers can be found at: <http://www.cec.org/Page.asp?PageID=1226&SiteNodeID=1282>

Complimentary Electronics Efforts:

- Links to the English and Spanish recordings of the R2 and e-Stewards® webinars can be found at:
 - R2: <http://www2.epa.gov/border2020/webinar-sustainable-materials-waste-management-and-clean-sites-2013>
 - e-Stewards: <http://www2.epa.gov/border2020/webinar-e-stewards-certification-program>
- Consumer Electronics Association Outreach PSAs can be found at: <http://www.psalibrary.com/library/ecycling/#!/prettyPhoto>
- ISRI's Jason Project school age curriculum can be found at: <http://www.jason.org/partner/isri>
- Frequent Questions on the CRT regulation can be found at: <http://www.epa.gov/waste/hazard/recycling/electron/crt-faq.htm>