



U.S. Environmental Protection Agency  
Office of Resource Conservation and Recovery

# Electronics Waste Management In the United States Through 2009

## Executive Summary

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**United States Environmental Protection Agency**  
**Solid Waste & Emergency Response**  
**Washington, DC 20460**

The full report, *Electronics Waste Management in the United States Through 2009*,  
is available at [www.epa.gov/cycling](http://www.epa.gov/cycling)



# Executive Summary

**Consumer electronics** have become increasingly popular and culturally important over the past several decades, changing how we communicate, get information, and entertain ourselves—and the speed with which we do so.

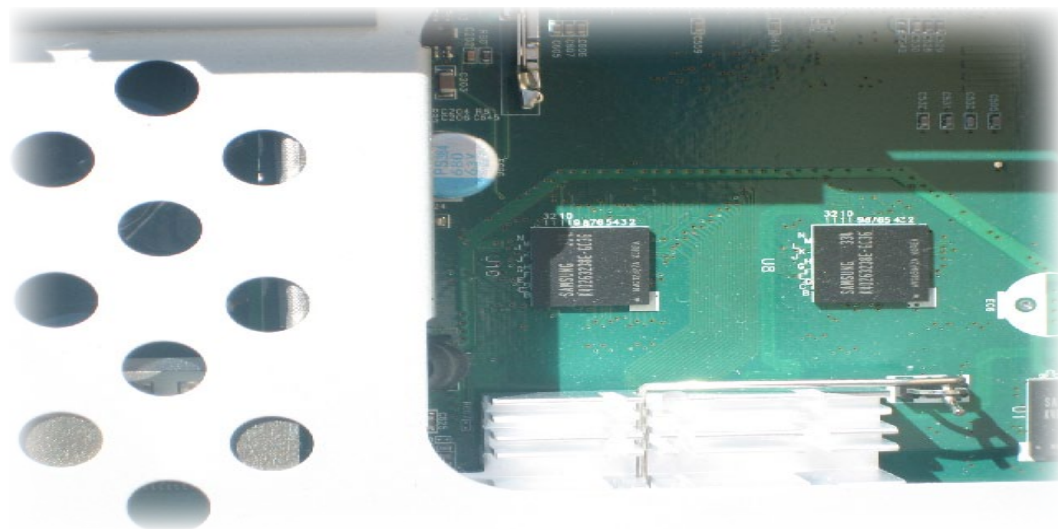
As the nature, use, and number of electronic products change over time, patterns of sales, storage, and end-of-life management (disposal and collection for recycling) also change. Waste managers, manufacturers, and policymakers need reliable and current information to inform and improve the management of used electronics. This Executive Summary provides an overview of the report, *Electronic Waste Management in the United States Through 2009*.

Used electronics comprise approximately one to two percent of the municipal solid waste stream, but they garner a great deal of interest for several reasons:

- rapid sales growth and change in the sector are generating a growing stream of used electronics needing appropriate management;
- electronic products contain diverse material inputs and scarce resources, many of which can be recovered;
- the presence of substances of concern in some electronics, particularly older products, merits greater consideration for safe end-of-life management; and
- opportunities for resource conservation and materials recovery through increased reuse and recycling of electronics.

## We estimate that in 2009:

- 438 million new electronic products were sold;
- 5 million short tons of electronic products were in storage;
- 2.37 million short tons of electronic products were ready for end-of-life management; and
- 25 percent of these tons were collected for recycling.



To better understand and quantify the movement of used electronics, we analyzed select electronic products from residential and commercial/institutional users that were sold in the United States from 1980 through 2010. We looked at the electronic product categories listed below. We chose these categories because they cover a broad range of electronic products commonly targeted by stewardship and recycling initiatives at the federal, state, and local levels.

- Computers: desktop central processing units (CPUs) and portables
- Computer displays: cathode ray tube (CRT) monitors and flat-panel monitors
- Keyboards and mice
- Hard-copy devices: printers, fax machines, scanners, digital copiers, and multi-function devices
- Televisions (TVs): monochrome, cathode ray tube (CRT), flat-panel, and projection
- Mobile devices: cell phones, personal digital assistants (PDAs), smartphones, and pagers



The full lifecycle of electronic products includes the acquisition of raw materials, manufacturing, purchase and use, storage, and end-of-life management (recycling or disposal). This report models the number and weight of electronic products that are in use, storage, and end-of-life management in a given year; extending from purchase to the point when the product is either disposed or collected for recycling. The subsequent management and processing of electronic products that were collected for recycling involves a different methodology which EPA has not yet developed. Consequently, this report does not attempt to quantify the portion of electronic products collected for recycling that are subsequently exported.



The data elements in the model include sales, product weights, lifespan and storage estimates, and the quantity of used electronic products collected for recycling. We used [sales](#) data to determine the number of electronic products entering use in a given year and [weight](#) data to estimate the total tonnage of these products. We used shipment data from International Data Corporation, Consumer Electronics Association, and an INFORM report to estimate sales. We projected sales for 2008-2010 based on trends in the shipping data, literature, and communications with industry experts. Using data from an electronic product brand distribution project conducted in Florida from 2004 to 2006, we estimated the [lifespans](#) of each electronic product category. From literature and communication with industry experts, we developed assumptions of how long products are in [use](#) versus [storage](#), and modeled the total number and weight of electronic products in use, storage, or end-of-life management for each calendar year.

To determine the quantity of used electronics [collected for recycling](#), we estimated the amounts of used electronics collected from residential and commercial sources. For used electronics collected from residential sources, we took data from eight state-mandated electronics recycling programs, covering 29 percent of the U.S. population and combined it with an assumption that one pound of electronics per capita is collected for recycling from the remaining 71 percent of the population. This assumption is consistent with states reporting low levels of collection and reflects our understanding that electronic products are collected through various municipality or manufacturer sponsored programs in varying amounts but reporting is not in place. From the quantity of used electronics collected from residential sources, we then back-calculated the total amount of used electronics collected for recycling, assuming that used electronics collected from commercial/institutional sources accounted for 67 percent of the total, based on survey information from recyclers. To estimate the rates at which mobile devices are collected for recycling we used the results of a small survey of recyclers.

**Table ES-1: Total products at end-of-life, in storage, and in use in 2009**

	Computers		Computer displays		Hard-copy devices	
	units ('000s)	short tons	units ('000s)	short tons	units ('000s)	short tons
Total sold (1980–2009)	857,000	7,570,000	653,000	11,000,000	471,000	4,050,000
In use	325,000	2,430,000	191,000	2,590,000	167,000	1,450,000
Total in storage	70,500	742,000	40,200	862,000	41,400	352,000
At end-of-life	462,000	4,400,000	422,000	7,560,000	262,000	2,250,000
	Keyboards and mice*		TVs		Mobile devices	
	units ('000s)	short tons	units ('000s)	short tons	units ('000s)	short tons
Total sold (1980–2009)	1,670,000	1,460,000	772,000	25,400,000	1,660,000	257,000
In use	368,000	311,000	312,000	11,200,000	812,000	94,100
Total in storage	Not Estimated	Not Estimated	104,000	2,930,000	57,800	9,270
At end-of-life	1,310,000	1,150,000	356,000	11,300,000	789,000	154,000

\*Keyboards and mice are each counted individually and the model did not include any storage estimates.

**Table ES-2: Rate at which used electronics are collected for recycling relative to the total weight of each product ready for end-of-life management, 2006 to 2010**

*\*Results are projected for 2010 based on estimates from previous years.*

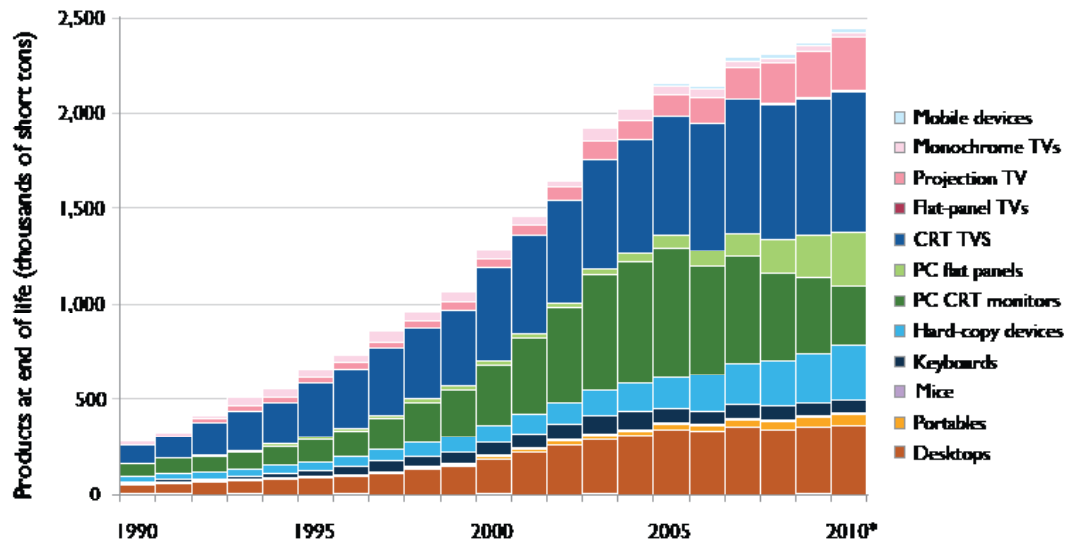
Calendar year	Computers	Computer displays	Hard-copy devices	Keyboards and mice	TVs	Mobile devices	Total
2006	33%	21%	37%	7%	16%	6%	22%
2007	36%	24%	38%	7%	17%	7%	24%
2008	38%	26%	35%	7%	16%	11%	24%
2009	38%	29%	34%	8%	17%	8%	25%
2010*	40%	33%	33%	10%	17%	11%	27%

Note: The rate at which mobile devices are collected for recycling each year varies more significantly from year to year, compared to other product types, because of variation in actual collection of mobile devices and the quality of collection reporting.

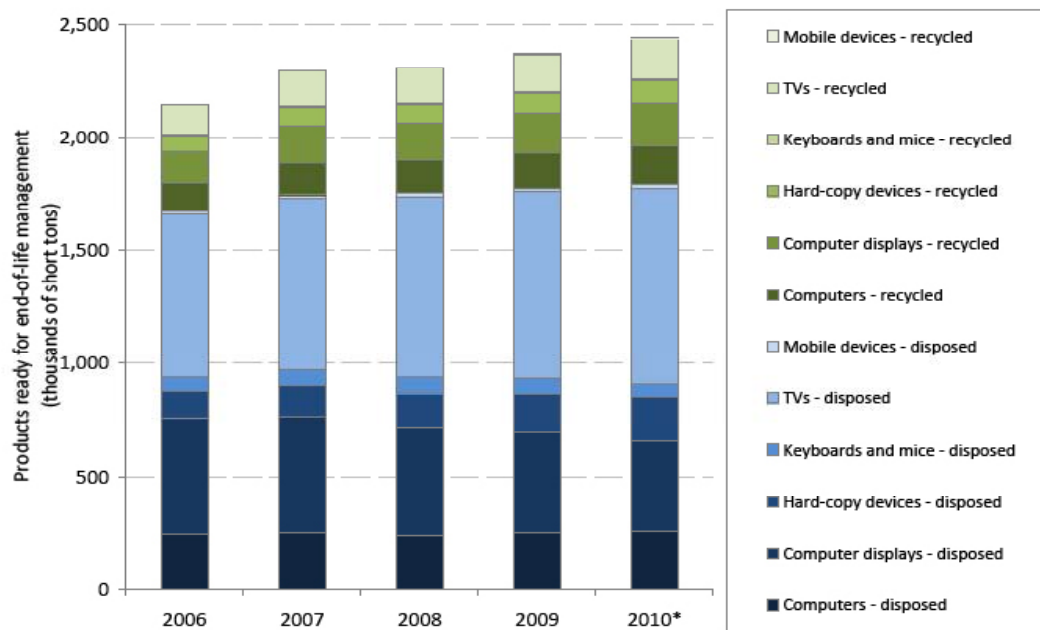
According to our analysis and projections:

- Sales of new electronics are driving increases in the use, storage, and end-of-life management of electronics. An estimated 438 million electronic products were sold in 2009, which represents a doubling of product sales from 1997 - driven by a nine-fold increase in mobile device sales.
- 2.37 million short tons of used electronics entered end-of-life management in 2009, which represents an increase of more than 120 percent of the quantity of electronics discarded from 1999. Table ES-1 details the number of electronic products by category that entered end-of-life management in 2009.
- CRT TVs and CRT monitors comprised nearly half, by weight, of the electronics that entered the waste stream in 2009.
- 141 million mobile devices entered end-of-life management in 2009, more than any other type of product included in the analysis, yet they comprise less than one percent of end-of-life electronics by weight.
- 25 percent of electronic products were collected for recycling in 2009. Table ES-2 provides information on the rates at which individual electronic product categories were collected for recycling. If recent trends in the growth of electronics collected for recycling continue, this will likely reach 27 percent in 2010—an increase of 179,000 short tons relative to 2006. This quantity could increase further as new state programs are implemented.
- Five million short tons of electronic products were in storage in 2009. Residential households currently store five times more computer products than commercial establishments.

**Figure ES-1: Quantity of electronic products ready for end-of-life management in the United States.** \*Results for 2010 are projected based on estimates from previous years.



**Figure ES-2: Quantity of electronic products collected for recycling or disposed of, by year.** \*Results for 2010 are projected based on estimates from previous years.



Our new estimate for the tonnage of electronic products collected for recycling in 2007 is 30 percent higher than our earlier estimate in our 2008 report. We believe this change results primarily from improvements to the methodology in estimating the amount of used electronics sent for recycling, rather than real changes reflected in the data. Due to the lack of robust data, there is still a high level of uncertainty in the actual quantity of used electronics collected for recycling.

Our estimate of the quantity of used electronics collected for recycling is highly sensitive to three assumptions: first, that one pound per capita of electronics is collected for recycling from states that do not report collection amounts; second, that there is a relationship between the amount of electronics collected from residential and commercial sources; and third, that 67 percent of used electronics collected for recycling come from commercial sources. Other important sources of uncertainty in the data on electronic products include their: average weights, lifespans, the period of time they spend in storage, and the rate at which they are collected for recycling.

Although this analysis provides an overview of the current management of electronics in the United States using the best data available, its broad scope does not account for variations at the regional, state, and local levels that are likely to influence the larger picture. Further research, data collection, and collaboration among all stakeholders, will be essential in developing a clearer picture of the management of used electronics in the United States in the future.

