Electronics Product
Stewardship Canada

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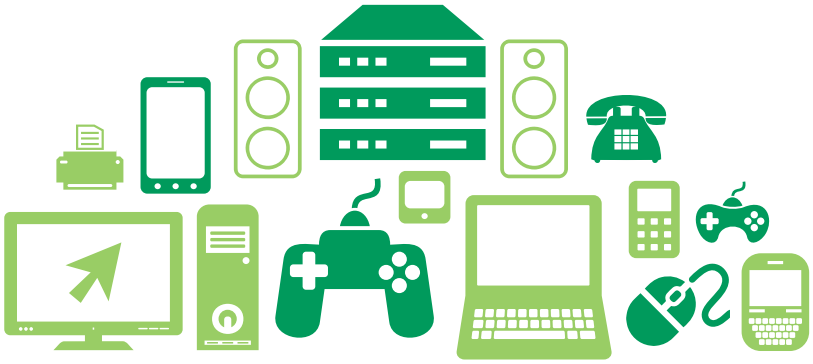


EPSC | 2015 Design for Environment Report

Message from the Electronics Product Stewardship Canada

All Canadians have a stake in contributing to solutions for climate change and in conserving our natural resources, particularly energy. We are part of a global ecological and economic system that Canadians both contribute to and benefit from.

This year's *Design for Environment* report illustrates the continuous changes being made in electronics design, composition, energy use and transportation which benefit the environment.

The big stories for us this year are:

- Continued decrease in resources used to manufacture and transport our products.
- Dramatic reduction in the energy used by electronic devices.
- Product life spans are being extended with increased durability of products and the thriving reuse and refurbishment economy.
- Shift from onsite data storage to shared or "cloud" data storage resulting in great resource efficiencies and greater mobility.

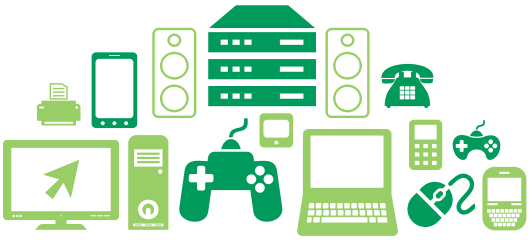
In addition, the Canadian approach to waste electrical and electronic equipment (WEEE) recycling programs has led to reductions in greenhouse gas (GHG) emissions and reductions in the need to mine new materials.

The impacts of device mobility, cloud computing and eco-labels are outlined in this report highlighting how product design contributes to the reduction in the average Canadian's carbon footprint.

These industry initiatives and many others are helping Canadians contribute positively to protecting our global environment.

Shelagh Kerr
President and CEO

Lloyd Bryant
Chair of the Board



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Efficient Energy Use

The electronics industry supports voluntary, market-oriented energy efficiency programs and initiatives. Electronics manufacturers are continually working to improve the energy and resource use efficiency of their products so that customers can enjoy the newest technologies while also reducing their carbon footprint.

One example of a voluntary and globally aligned program is the **ENERGY STAR** labelling program, administered by Natural Resources Canada. The ENERGY STAR label was established to reduce greenhouse gas emissions and other pollutants caused by the inefficient use of energy and to make it easy for consumers to identify and purchase energy-efficient products that offer savings on energy bills without sacrificing performance, features, and comfort.[1]

EPSC members proudly display the ENERGY STAR label on their many qualified products, helping Canadian customers to easily identify energy-efficient products. The full list of qualified electronics products can be viewed on the *Natural Resources Canada website*[2]. Electronics products that are eligible for **ENERGY STAR** include: computers, displays (monitors), imaging equipment, small network equipment, televisions, audio/video products, cordless telephones, set-top boxes and recently added servers and data storage devices.[3]

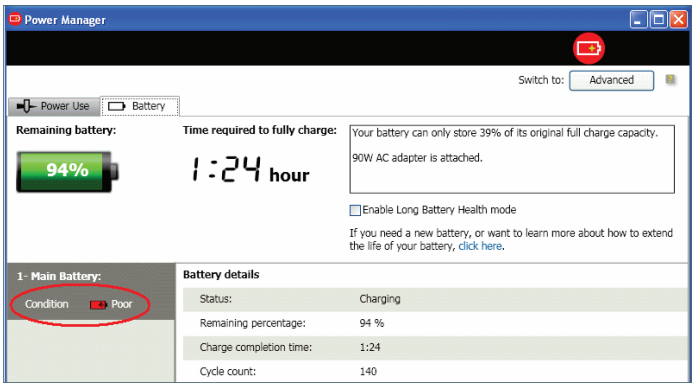
Power Management

Manufacturers are providing power management options on easy to access menus, making the choice of saving energy readily available to the user. Manual powersaving options also allow users to implement their own energy saving routines.[4]

Lenovo's ThinkVantage Power Manager is a power management program that helps users and IT administrators adjust power settings to achieve the best balance between system performance and power savings. Business customers deploying ThinkCentre M58 Tower PCs can save approximately $71 per year, per user, by enabling Power Manager.[5] This type of efficiency management program allows businesses and consumers to not only save money but reduce their carbon footprint as well.

Through the introduction of energy efficient technologies such as *induction heating and on-demand fixing,* reducing standby times to one-tenth of previous wait times for copying machines, multi-function devices and laser printers, **Canon** estimates that cumulative global CO2 emissions on the part of their customers were reduced by approximately 7,600,000 metric tonnes (or 8,370,000 tons) over the six-year period of 2008 to 2013.[6]

Lenovo's ThinkVantage Power Manager



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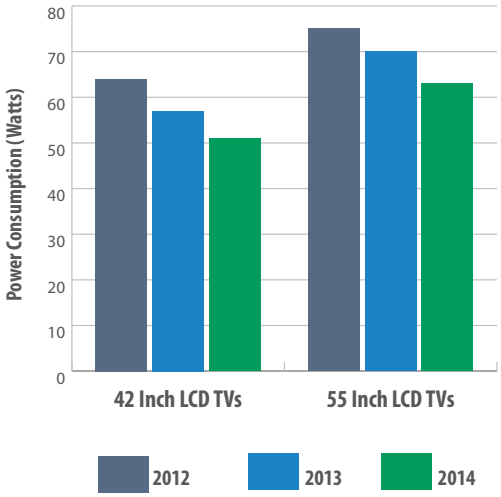
Energy Efficient Products

When in use, an electronics product can be energy intensive. For this reason, energy efficiency has always been a key design criteria. Increasing product energy efficiency can help decrease the user's energy costs, reduce energy demand, and lower GHG emissions.

Panasonic From the years 2012-2014, **Panasonic** improved the energy efficiency of their HD LCD TVs by 16-20% when compared to their predecessor models. The chart on the right details the power consumption for 42 and 55-inch models.



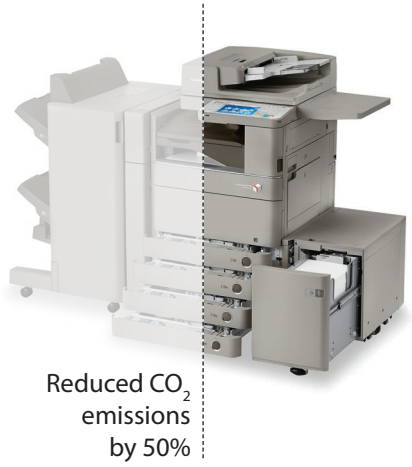
Design features that reduce energy consumption during the usable life of an electronics device can include:

- Products automatically powering down when not in use.
- Use of sensors to detect device or appliance usage patterns.
- Backlighting on displays automatically adjust brightness based on surroundings.

Many of **Panasonic's** products are equipped with **ECONAVI Intelligent Sensors** that can detect the unconscious waste of energy using **Human Activity Sensors** and **Sunlight Sensors.** These sensors are able to monitor human location, movements, absence and sunlight intensity. Televisions with this function control screen brightness based on where people are located and the brightness of the room.[7]

Canon **Canon's** imageRUNNER ADVANCE C5200 Series Imaging Equipment was designed specifically for low carbon dioxide emissions. Calculation of CO_2 emission quantities was included in the design process from the outset. The combined CO_2 emission amount for power consumption, materials, and logistics for one image RUNNER ADVANCE C5200 Series product is 50% lower compared to previous models.[8]

Canon's imageRUNNER ADVANCE C5200



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Efficient Resource Use

Thinking about recycling during product design and manufacturing

When products are designed for recyclability, costs are reduced during both the end of life recycling phase and during manufacturing. Products designed to be efficiently recycled have the following considerations:

- Reduction in the number and types of materials used.
- Use of standardized plastics labelling such as the ISO 11469 standard.
- Use of molded-in colours and finishes instead of paint, coatings or plating whenever possible.
- Minimizing the number of fasteners and the number of tools necessary for disassembly.[9]

Apple designers and engineers have continued to pioneer new ways to build their products with less material. Manufacturing innovations such as unibody construction have allowed products like iPad, MacBook Pro, and MacBook Air to become thinner while being even more resilient. Today's Mac Pro uses 74% less aluminum and steel than the previous design. And the newest iMac is made with 68% less material than the first iMac.[10]

40 to 50x
greater concentrations of valuable materials, such as
Gold, Silver & Platinum,
than mined ore extraction

Giving Waste a Second Life

Much of what is referred to as "e-waste" is not waste at all but rather whole electronic equipment or parts that can gain new life through reuse or recycling. The recovery and responsible recycling of the materials found in end of life electronics can displace those sourced from mining. This reduces the negative environmental impacts caused by mining, particularly greenhouse gas emissions associated with extracting and refining virgin raw materials. For example, e-waste can provide 40 to 50 times greater concentrations of valuable materials, such as gold, silver and platinum, than from mined ore extraction. This means that more materials are available for the same amount of effort, while environmental pollution, including emissions, is reduced.[11]

Lenovo started using *post-consumer recycled content (PCC) plastics* in the manufacture of selected desktops and monitors in early 2007 and today uses PCC across all PC product categories, including in all Lenovo desktops, All-In-Ones, workstations, notebooks and servers. Currently, almost all ThinkPad Edge notebooks and ThinkPad L notebooks contain at least 10% post-consumer recycled content. Many Lenovo commercial desktops use significant amounts of PCC including the ThinkCentre M92p Tiny (39%), the ThinkCentre M92p and M82 Tower (42%), and the ThinkCentre M92p and M82 Small Form Factors (36%).[12]

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HP: Closed Loop Cartridge Recycling Program

HP's award-winning closed loop cartridge recycling program, available to customers worldwide, provides a free and convenient way to recycle Original HP ink and LaserJet print cartridges. The HP Planet Partners Program also responsibly recycles hardware, rechargeable batteries and wide format media. In 2005, HP began to produce ink cartridge lids and bodies using recycled PET (RPET), with a portion of the material sourced from the HP program. RPET plastic from this process has a 33% lower carbon footprint and 54% lower fossil fuel consumption in its production than new plastic – even when accounting for the environmental impact associated with collecting, transporting, and processing used cartridges and plastic bottles. Manufacturing Original HP ink cartridges with recycled plastic instead of virgin plastic has reduced greenhouse gas emissions by 6,900 tonnes in 2013.

As of the end of January 2014, HP had manufactured more than 2 billion Original HP ink and toner cartridges using more than 62,000 tonnes of recycled content material. Through this process, HP has kept 566 million cartridges, 498 tonnes of polypropylene hangers, and 2.5 billion postconsumer plastic bottles out of landfills.[13]

2014 Clean50
Outstanding Contributors to Clean Capitalism
TOP 15 PROJECT

Dell: Closed Loop Recycled Content

Another example of an EPSC member using "waste" as a resource is **Dell.** With the launch of the OptiPlex 3030 All-in-One computer in June 2014, Dell became the first in the industry to offer a computer certified by a third party (UL Environment) to a closed-loop recycled plastics standard.[14]

By reusing plastics from old electronic products, Dell is cutting down on e-waste, saving resources and *reducing carbon emissions by 11% compared with virgin plastics.* At the end of 2014, 16 display models and 3 desktop computer models were shipping globally with closed loop recycled plastics.

11% fewer carbon emissions than virgin plastics
Dell: Closed Loop Recycled Content

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Product Durability – Extending Product Lifespans

Manufacturers are developing products that are increasingly durable and long-lasting. The utility of many of today's electronics devices is derived from innovative software and applications. Today, electronic users can update and upgrade to the latest software available without having to purchase new hardware. This results in greater resource conservation by eliminating the need to manufacture and ship a new device when new features and functionality become available. These innovations also result in significant cost savings to the user.

SAMSUNG **Samsung's** *SEK 1000 Evolution Kit* is an innovative product that allows customers to upgrade the TV's multimedia contents, picture quality and smart functions upon its installation on the existing TVs, thereby extending product life cycle.

Samsung's *SEK 1000 Evolution Kit*

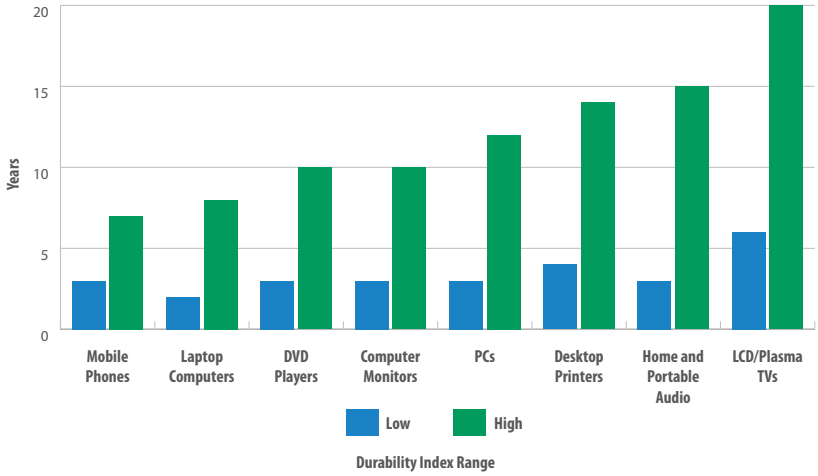
Apple has made it very easy for users to update to new versions of apps, software, and entire operating systems—OS X Mavericks (released in 2014) works on Mac computers made as far back as 2007—so users can experience the latest interface without having to buy a new device.[15]

The chart below illustrates the average lifespans of today's electronic products (US EPA data[16]). As indicated above, products are being designed to have longer usable lives through the use of new materials, new technology and upgradable software. However, many other factors can affect product lifespan ranges including variance in storage time before disposal and disruptive technological advances (i.e., smartphones, analog to digital television). These variables make it very difficult to predict typical disposal rates from year to year. Pre-determined collection targets for electronics recycling are unrealistic.

Sony's Laser Light Source 3LCD Projectors

SONY Previous generations of projection devices use lamps for illumination. Lamps inevitably fade over time and require replacing, which creates waste. In contrast, the **Sony** *Laser Light Source 3LCD Projectors* last significantly longer for up to 20,000 hours compared to conventional lamp projectors where lamps need to be replaced at intervals of approximately 3,000 hours.[17]

Sony *Laser Light Source 3LCD Projector*



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Industry Managed Reuse and Refurbishment Programs

The electronics industry recognizes that the lives of devices can be extended substantially through reuse and refurbishment programs for customers. Manufacturers prefer to maximize the value of their assets through resale as opposed to simply incurring costs for end-of-life recycling.

In 2013, electronics manufacturers themselves took back approximately 8,000 tonnes of electronics products in Canada for the purpose of reuse and refurbishment.

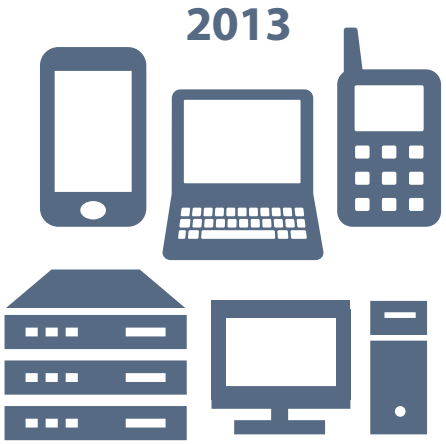
The informal consumer market also enables our devices to have extended second lives through gifting to family, small repair and refurbishment businesses, charitable organizations and online second hand sales.

Microsoft Authorized Refurbisher (MAR) Program

Microsoft AUTHORIZED Refurbisher

The Microsoft Authorized Refurbisher (MAR) program enables qualified refurbishers to differentiate themselves in the marketplace by supplying refurbished computers preinstalled with genuine Windows software. MAR program participants refurbish and resell computers and servers using data security and environmental best practices and compliance methods and are subject to audit by the program administrators.[18] Programs such as MAR create the opportunity for Canadian customers to purchase second hand hardware with confidence, thereby further extending the life of electronics devices.

Reuse and refurbishment activities in Canada extend the life span of products, reducing the need for new materials and energy for the manufacturing of a new device. This reduces GHG emissions. Reuse and refurbishment activities also create a marketplace for lower cost, but still well-functioning products.



Canadian Electronics Manufacturers Took Back Approximately

8,000 Tonnes

Electronics Products For Reuse and Refurbishment

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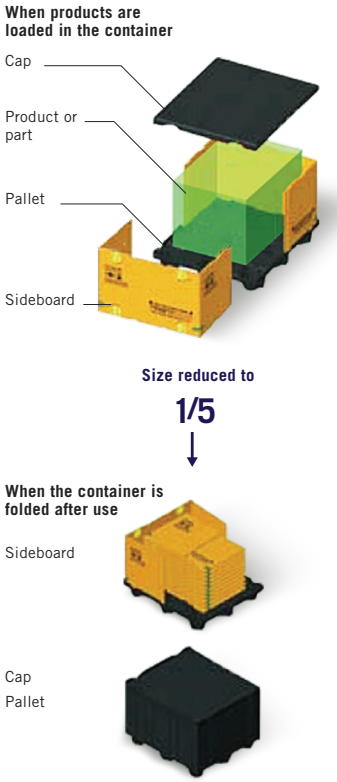
Efficient Packaging Design and Transportation

Electronics manufacturers conserve resources and energy by optimizing packaging design through improving material recyclability, reducing the amount of material used, introducing recycled content and optimising logistics. Product packaging optimisation enhances energy and resource efficiency.

Sony's standardized cartons

Structural overview of a returnable container



After use, returnable containers are stacked and returned.

SONY **Sony** reuses packaging materials and reduces waste by using returnable containers, which can be reused repeatedly for products and parts transport. Returnable containers are designed to enable efficient loading onto sea freight containers. Since 2009, Sony has been operating logistics using modular size (standardized) cartons which fit efficiently into returnable containers. By using modular cartons that match the storage requirements of each part, Sony has enhanced parts storage efficiency and optimized the number of units shipped in each container[19].

SAMSUNG **Samsung** has significantly reduced energy used and GHG emissions from transportation by utilizing shrink-wrap packaging and recycled packaging materials, both of which improve recyclability and reduce weight during shipment. Shrink packaging is a technique that compresses products and packaging materials with heat. This technique reduces the weight of packages by an average of 44% compared to paperboard packaging, thereby reducing transportation costs and cutting down GHG emissions from transportation, too.[20]

Dell is striving to source 100% of their packaging from sustainable materials. **Dell** has turned to Newlight Technologies' AirCarbon™ for a pilot project to manufacture protective bags out of plastic made not from oil but from captured carbon emissions. This process sequesters more carbon than it produces, pulling carbon from the air and generating a net positive impact on the environment. While the initial pilot project will focus on packaging – specifically for the protective bags for Dell Latitude notebooks shipped to the U.S. and Canada – AirCarbon's functional flexibility makes it attractive for other possible uses with Dell products.[21]

SmartWay

The **SmartWay Transport Partnership,** administered in Canada by Natural Resources Canada since 2012, is a collaboration designed to help businesses reduce fuel costs while transporting goods in the cleanest most efficient way possible. SmartWay works with freight carriers and shippers committed to benchmarking their operations, tracking their fuel consumption and improving their annual performance.

Fuel efficiency improvements by SmartWay-registered Canadian truck carriers in 2013 alone have resulted in the reduction of diesel fuel use by over 50 million litres.[22] Many EPSC members are registered SmartWay partners including: **Canon, Dell, EMC, Epson, Fujitsu, HP, IBM, Lexmark, Microsoft, Panasonic, Sony** and **Xerox.**

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Technology is Changing How We Work

The electronics industry's development of virtualization and cloud services by both manufacturers and service providers have helped to reduce device sizes and weights, the amount of material needed during the manufacturing process and energy consumption for the commercial sector has been reduced.

One noticeable change is that user data is no longer stored under your desk or onsite. Cloud computing has enabled the delivery of on-demand computing resources, everything from applications to data centres, delivered over the Internet. In the past, businesses would host these applications locally, resulting in inefficiencies and high energy consumption.[23] Today, shared resources are consolidated in data centres enabling companies to run fewer servers, which can lead to savings. Big data both speeds the pace of work for the user or business, while also allowing for greater mobility.

Data Centres

IBM introduced a range of flash-based storage systems designed for data centre applications. Flash storage reduces energy use by 60% or more compared to disk drives, and significantly improves server and storage performance by minimizing the latency associated with data transfer within data centres.[24]

HP's *Project Moonshot,* is a program aimed at developing a new generation of extreme low-energy and high-density servers. By sharing management, power, cooling, networking and capacity across a large number of units, computing capability is increased while reducing resource use. A rack that once held 64 standard servers, accommodates 1,800 Moonshot servers. The *Moonshot* system consumes up to 89% less energy, uses 80% less space, and costs 77% less than a traditional server environment. Replacing 100,000 standard servers with *Moonshot* reduces GHG emissions equivalent to removing 18,000 cars from the road for one year.[25]

HP's *Project Moonshot Server*

Mobility

As noted above, great energy and cost savings for business operations can be achieved by utilizing cloud computing services. The carbon footprint of individual workers can also be reduced with the application of this technology. Increased worker mobility afforded through cloud computing has enabled work from home programs that reduce employee work commutes. These types of programs not only help employees balance their work and personal responsibilities, but also have great benefits for the environment. In 2013, **IBM's** work-at-home program conserved approximately 21 million litres of fuel and avoided more than 44,000 metric tonnes of CO_2 emissions (U.S. data).[26]

Cisco is also helping to reduce commercial operating costs by facilitating teleworking and increased employee mobility. Services such as Cisco Virtual Office, OfficeExtend, and Cisco Connected Workplace have reshaped the idea of work environments, reducing facility needs, making more efficient use of office space and reducing employee environmental impacts by minimizing the commuting and business travel.[27]

In 2013, IBM's work-at-home program conserved approximately 21 million litres of fuel and avoided more than

44,000 metric tonnes of CO_2 emissions

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Helping Customers Make More Sustainable Purchasing Decisions

Environmental standards and product labelling both play an active role in helping customers to identify products with a lower environmental impact.

EPEAT

EPEAT (Electronic Product Environmental Assessment Tool) is a comprehensive environmental rating system for electronic equipment, including *PCs and displays, imaging equipment and televisions.* EPEAT is used globally by companies, universities and government agencies to identify greener electronics to purchase. EPEAT's rating system enables customers to view and compare the environmental performance of electronic products throughout their life cycle. For participating manufacturers, EPEAT is a chance to gain market recognition for greener designs and cleaner production.

The **EPEAT Registry** was first launched in Canada in 2009. Today over 1500 products are registered in Canada and the list continues to grow. The full list of EPEAT registered products can be accessed by visiting the **EPEAT Registry** online at http://ww2.epeat.net. [28]

The criteria used by EPEAT address:[29]

- Reduction/elimination of environmentally sensitive materials.
- Material selection.
- Design for end-of-life.
- Product longevity/life extension.
- Consumables (unique to Imaging Equipment standard).
- End-of-life management.
- Corporate performance.
- Packaging.
- Energy Conservation.
- Indoor Air Quality (unique to Imaging Equipment standard).

ECOLOGO

ECOLOGO certified products, services and packaging are certified for reduced environmental impact. ECOLOGO certifications are voluntary, multi-attribute, lifecycle-based environmental certifications that indicate a product has undergone rigorous scientific testing, exhaustive auditing, or both, to prove it's compliance with stringent, third-party, environmental performance standards.[30] These standards set metrics for a wide variety of criteria in some or all of the following categories: materials; energy; manufacturing and operations; health and environment; product performance and use; and product stewardship and innovation.

ECOLOGO standards are designed so that only the top 20% of products available on the market can achieve certification. More than 7,000 products, including computers, imaging equipment, printing cartridges, printing inks, mobile phones, monitors, office machines (floor-standing multi-function devices) and televisions, carry this logo.[31] EPSC members with ECOLOGO certified products include: **Dell, Hewlett-Packard Canada, Lenovo, LG, Electronics, Inc., Lexmark International, Inc., Microsoft, Ricoh Canada Inc., Samsung Electronics Co., Ltd.** and **Xerox Canada Ltd.**

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Diversion from Landfill and Canadian WEEE Recycling Program's Impact on GHG Reductions

GHG emissions from waste are largely generated by the degradation of organic waste in landfills.[32] However, reducing, reusing and recycling non-organic waste is also critical to reducing Canada's overall carbon footprint.

With respect to Waste Electrical and Electronic Equipment (WEEE), GHG emissions reductions can be achieved through participation in recycling programs. Responsible recycling of electronics diverts material from landfill while also creating a new source of second-life feedstock for manufacturing and less reliance on virgin materials.

The mining required to harvest the materials needed to manufacture electronics products can be associated with various environmental impacts, including GHG emissions. Recovering materials from the responsible recycling of electronics products, or "urban mining", helps to offset these impacts as it requires significantly less resources and energy.

PRé Consulting created a methodology for The Netherlands, to estimate the environmental benefit of recycling of WEEE compared with using virgin materials. The methodology indicates that the amount of avoided CO_2 equivalents per tonne of e-waste recycled is 0.9 tonnes for Information and Communications Technology (ICT) equipment and 0.3 tonnes for Cathode Ray Tube (CRT) devices (older model televisions and computer monitors).[33]

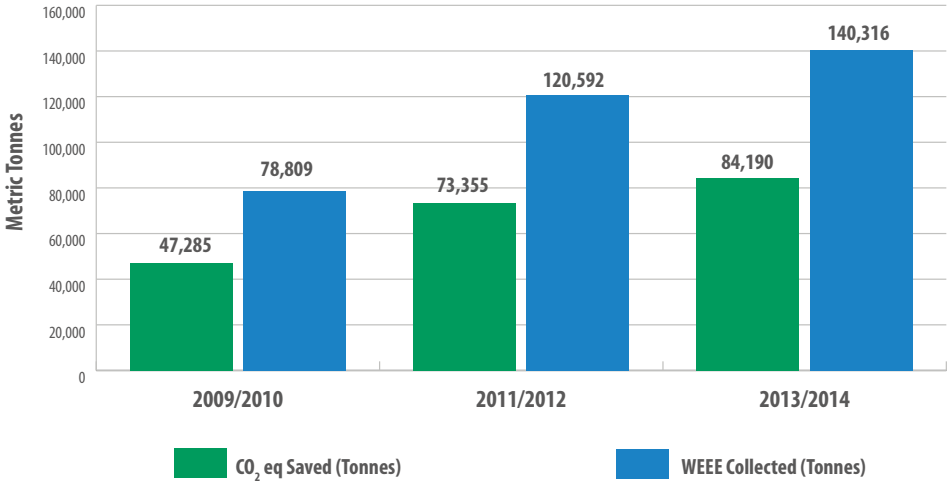
Canada recycled 140,000 tonnes of electronics in 2013,[34] as reported by Electronics Product Recycling Association (EPRA), Ontario Electronics Stewardship (OES) and Alberta Recycling Management Authority (ARMA). Using the methodology outlined above, the total emission reductions achieved through the recycling of Canada's electronics products equal approximately 84,000 tonnes of CO_2 equivalents.

According to the U.S. EPA's Greenhouse Gas Equivalencies Calculator,[35] Canada's WEEE recycling activities equal the removal of 17,684 passenger vehicles from the roads annually or the CO_2 emissions from 35,860,675 litres of gasoline consumed.

The CO_2 equivalents saved from Canada's WEEE Recycling Activities Equal the Removal of

17,684

Passenger Vehicles Annually



WEEE recycling programs operating in Canada over the past five years.

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Public Policy Supporting the Environment

IC&I Electronics Products

Consumer and business electronic products are essentially two separate markets, both with well-functioning end-of-life management but taking different forms. Electronics products designed for use in an industrial, commercial and institutional (IC&I) setting, such as floor standing printers, mainframe servers, and other large commercial products, are not likely to end up in landfill and are highly sought after by refurbishers and OEMs for re-use, refurbishment as well as recycling value. IC&I generators will manage their wastes through commercial contracts. In 2013, EPSC collected data indicating that electronics manufacturers themselves took back approximately 8,000 metric tonnes of electronics products in Canada for the purpose of reuse and refurbishment. OEM and generator managed IC&I take-back programs ensure that the full market value of these valuable and long-lasting products is realized.

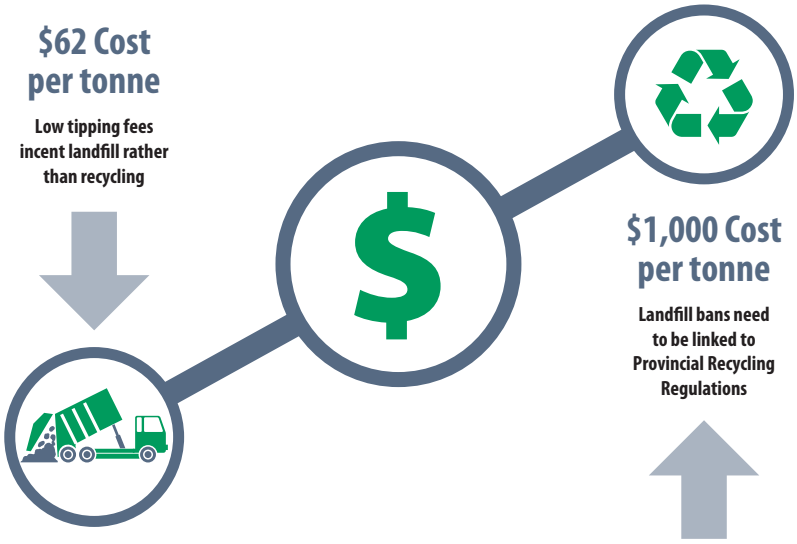
A great example of one of the many OEM take-back programs comes from **Cisco Systems Inc.** In 2014, **Cisco** collected 12,180 metric tonnes of Cisco products from North American customers for the purpose of reuse and recycling, resulting in the reuse of over $360 million of equipment.[36]

Landfill Bans

One of the most effective policy measures supporting electronics recycling is a provincial disposal/landfill ban of electronics. This action effectively closes the door to disposal as an option. Nova Scotia, PEI and Newfoundland currently uphold province-wide landfill bans for electronics. In other provinces across Canada where such wide reaching bans are not in place, some municipalities have passed bylaws to divert end-of-life electronics from landfills. Provincial lanfill bans can help to further increase diversion rates, create significant cost savings for municipalities and give a second life to valuable raw materials.

Cost to Consumers via Eco Fees on Purchases
$140,402,528.00
Annual cost to responsibly recycle WEEE in Canada[37]

Savings to Municipal Taxpayer
$8,699,592.00
Annual Savings by Diverting WEEE from landfill across Canada ($62/tonne average tipping fee)[38]



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About EPSC

Electronics Product Stewardship Canada (EPSC) is a not-for-profit, industry-led organization working to represent the interests of electronics manufacturers for innovation in enhanced end-of-life solutions for electronic products in Canada.

EPSC members have shown environmental leadership by working with stakeholders to create effective environmental stewardship programs across Canada, by investing in design improvements to their products and processes, and by establishing an innovative standard for the responsible handling of end-of-life electronics.

Responsible electronics manufacturers are members of EPSC:

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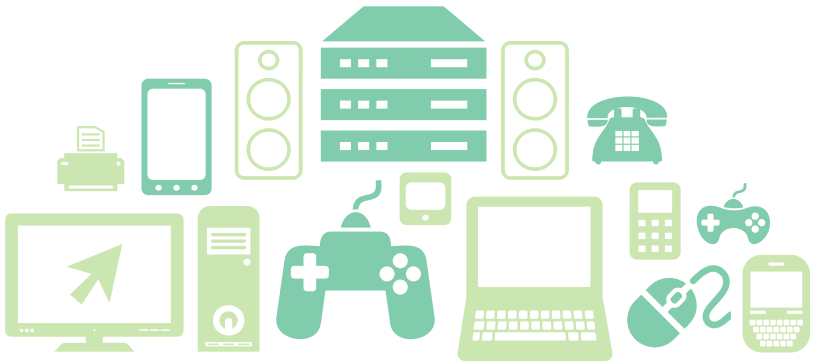

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