2018

DESIGN for ENVIRONMENT REPORT

epsc.ca

Electronics Product Stewardship Canada

Message from Electronics Product Stewardship Canada (EPSC)

We are proud to release our 10th Design for Environment Report. Today, end-of-life electronics are increasingly viewed as a resource rather than a cost to consumers and taxpayers. This represents a significant opportunity for our environment and economy across Canada.

This year's report highlights the value in end-of-life electronics and how we reduce our environmental footprint by continuing to:

- Reduce and reuse electronics and recycle materials
- Optimize product design for electronics disassembly, reuse and durability
- Balance product functionality with environmental improvements
- Repair and refurbish electronics
- Reduce product energy use
- Reduce use of materials of concern
- Ensure proper recycling for end-of-life products

Electronics products have come a long way over the past decade in reducing their environmental footprint. This has been accomplished with the support of Canadian consumers, regulators and a constant stream of innovations from manufacturers. We will continue to evolve our products and take back systems for the benefit of both consumers and the Canadian natural environment.

Jeff Van Damme
Chair of the Board
EPSC
(Samsung Electronics Canada Inc.)

Shelagh Kerr
President and CEO
EPSC

EPSC's Guiding Principles for Provincial and Territorial Electronics Stewardship Programs

1. **Level playing field:** All obligated producers participate in an approved stewardship program to maintain a level, competitive playing field.

2. **Alignment:** To the greatest extent possible, align provincial electronics stewardship programs to achieve efficiencies.

3. **Appropriate standards:** All recyclers used by an electronics stewardship program must be audited to the EPSC recycling standard – a standard that has been employed in every jurisdiction in Canada that maintains an end-of-life electronics stewardship program.

4. **Environmental improvement:** Use the program's influence on the market to drive environmental improvements such as proper reuse, responsible recycling and enhanced resource recovery.

5. **No cross-subsidization:** Each product category is assigned only the costs of managing those products within that category.

6. **Operational efficiencies:** Drive operational efficiencies by leveraging competitive markets for services and streamlining administrative and governance processes to ensure financial resources are used effectively and efficiently.

7. **Collective or individual responses:** The program should allow the flexibility for either an industry collective response or individual company responses.

Canadian Timeline: Design for Environment

Over the past twenty-five years, Canada built programs and introduced regulations to responsibly manage both new and end-of-life electronic products.

1992

Canada ratifies the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. The Basel Convention is an international treaty designed to reduce the movements of hazardous waste between nations, and to prevent transfer of hazardous waste from developed to less developed countries.

1995

Canada's Energy Efficiency Regulations come into effect, establishing energy efficiency standards for a wide range of energy-using products including consumer electronics.

2000

Canadian Environmental Protection Act (CEPA) comes into force in 2000. CEPA 1999 ensures the most harmful substances are phased out of products so they cannot be released into the environment.

2001

ENERGY STAR® label is introduced for electronics, to promote products with lower energy usage.

2003

EPEAT (Electronic Product Environment Assessment Tool) is developed to identify environmentally preferable electronic devices. EPEAT registers products in Canada.

2004

Alberta regulates a government-run electronics recycling program.

EPSC develops an Electronics Recycling Standard to ensure that end-of-life electronics are handled in a safe, environmentally sound and responsible manner.

2006

The Federal Government launches the Chemical Management Plan (CMP) under CEPA 1999, aimed at reducing risks posed by substances to Canadians and their environment. The first phase of the CMP begins. Substances in products are assessed to ensure no potential harm to human health and/or the environment.

Electronics manufacturers stop production of CRT's for television and monitors. This eliminates the major source of lead in end-of-life electronics.

2007

Regulated, industry-run electronics stewardship programs are launched in British Columbia and Saskatchewan.

2008

Regulated, industry-run electronics stewardship program is launched in Nova Scotia. A landfill ban on electronics is implemented.

2009

Regulated, industry-run electronics stewardship program is launched in Ontario.

CCME (Canadian Council of Ministers of the Environment) releases the Canada-Wide Action Plan for Extended Producer Responsibility including, product lists, a model program and model regulations.

2009-2014

Electronics manufacturers eliminate mercury-based lamps in displays and replace them with mercury-free LEDs and OLEDs.

2010

Regulated, industry-run electronics stewardship program is launched in Prince Edward Island.
A landfill ban on electronics is implemented.

2011

The Federal Government begins the second phase of the CMP. Substances in products are assessed to ensure no potential harm to human health and/or the environment.
EPSC participates in the CMP Stakeholder Advisory Council.

2012

Regulated, industry-run electronics stewardship programs are launched in Québec and Manitoba.

Ontario passes the Energy and Water Efficiency – Appliances and Products Regulation, introducing energy efficiency standards for consumer electronics.

2013

Regulated, industry-run electronics stewardship program is launched in Newfoundland and Labrador.
A landfill ban on electronics is implemented.

2015

The Federal government introduces Products Containing Mercury Regulations to eliminate mercury content in many products, including electronic products.

B.C. passes the Energy Efficiency Standards Regulation, introducing energy efficiency standards to consumer electronics.

2016

Government-run electronics recycling program is launched in the Northwest Territories.

EPSC develops a screening tool to track Federal chemical reviews, helping industry to respond to consultations in a timely manner.

2017

Regulated, industry-run electronics stewardship program is launched in New Brunswick.

The Standing Committee on Environment and Sustainable Development submitted its review of CEPA. The Government responded and tabled the report.

The Federal Government begins planning for post-2020 chemical management in Canada.

Amendments to Quebec's Regulation respecting the energy efficiency of electronical or hydrocarbon-fuelled appliances introduces energy efficiency standards to several consumer electronic products.

Transition énergétique Québec (TEQ) is the new public body that is responsible for supporting, encouraging and promoting the energy transition, innovation and efficiency.

2018

Yukon Government-run electronics recycling regulations and program under development.

Since the release of the Canada-Wide Action Plan for Extended Producer Responsibility (EPR) in 2009, Canada has seen the introduction of EPR for electronics, paint, tires, batteries, engine oil, packaging and household hazardous materials. In 2017, the Canadian Product Stewardship Council (CPSC) commissioned a study identifying major strengths, obstacles, opportunities and weaknesses of the EPR model.[1] It is the first comprehensive study of stakeholder perspectives on EPR policy in Canada.

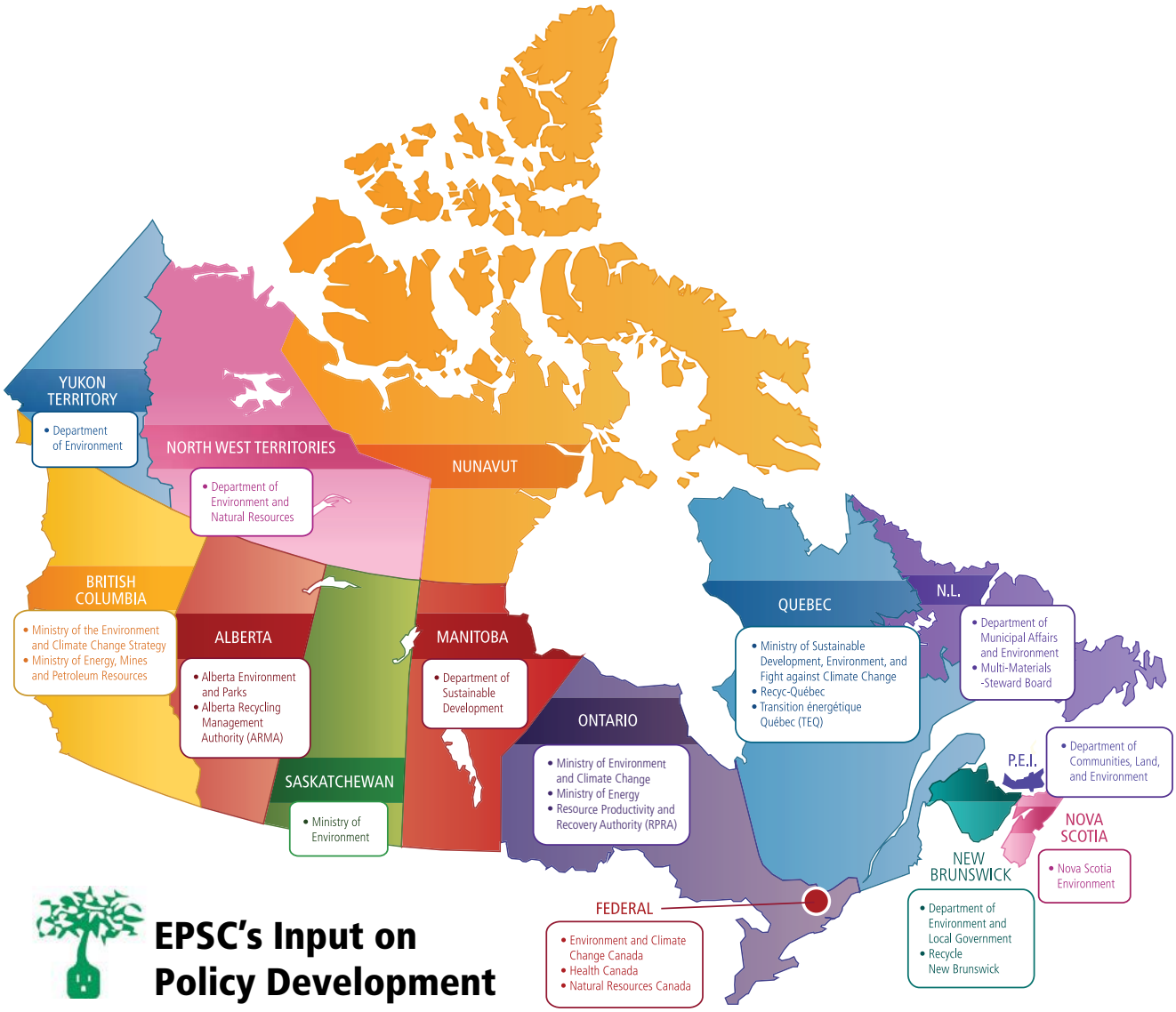
Key Findings

1. EPR is seen as neither a success nor a failure – it is a work in process
2. EPR is viewed as a funding mechanism that typically operates as a tax
3. EPR has no broader aspirations than recycling - waste avoidance or reuse in particular. It is not seen as part of a circular economy strategy in Canada
4. EPR's limiting factors are government policy and governance
5. Linkages between EPR and consumer behaviour are important, but largely missing
6. Weak and uneven enforcement of EPR, either inherent in legislation or in administration, is a significant barrier

EPSC continues to work with provincial governments to evolve the EPR programs in Canada.

Overview of EPSC: Our Role in Policy Development

EPSC represents the interests of electronics manufacturers for innovation in enhanced end-of-life for electronic products in Canada. Our membership consists of leading electronic product manufacturers. We work with them to provide input to regulators at the Federal, Provincial and Territorial level on energy efficiency, chemical management, and diversion of end-of-life electronics from landfill.



EPSC's Input on Policy Development

Updates on the 3 Rs (Reduce, Reuse and Recycle)

Reduce

Reducing Product Weight

Canon is revolutionizing printer design. For example, the 2016 TS8000 series inkjet printer PIXMA is about 44% smaller and 29% lighter than the older 2011 MG6200 series models.[2]

HPZ2 Mini G3 Workstation. Courtesy of HP Canada Co.

HP continues to shift towards creating smaller computer hardware that is more efficient without compromising performance. The HP Z2 Mini Workstation is packed with the performance of a traditional business-class tower in a size that's 90% smaller.[3]

Displays keep getting lighter. Portable projectors can now replace the need for conventional TVs. Sony's Wi-Fi Projector (LSPX-P1) is a capable of creating images up to 80". With no lightbulb or fan, the projector transforms a wall or table into a photo album or cinematic screen.[4] When comparing Sony's Wi-Fi projector with Sony's older TV model, the weight of this display technology has decreased by 96%, as shown below.

Display Technology Evolution

2003 Sony 30" XBR LCD WEGA® TV

Weight: 27.2 kg

2016 Sony Portable Ultra Short Throw Projector (LSPX-P1)

Weight: 0.9 kg

Evolving Management of Hazardous Substances

Electronics manufacturers are reducing and removing substances of concern from products and sourcing substances that are safer for the environment and workers.

International and Government Restrictions

Chemicals are tightly controlled through regulations and directives such as the European REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) and RoHS (Restriction of Hazardous Substances Directive). Since electronics are manufactured for global markets, directives like RoHS are significant drivers for reducing and eliminating materials of concern in electronic products sold in Canada. For example, Panasonic is discontinuing four types of phthalates specified by the RoHS Directive in new products globally, by July 2018.[5]

In Canada, substances are regulated through CEPA 1999 (Canadian Environmental Protection Act). EPSC supports the evaluation of chemicals based on sound science.

Procurement Polices and Supply Chain Communication

Electronics manufacturers work closely with approximately 2,500 global suppliers using specifications for restricting substances of concern. EPSC members make publicly available polices and specifications on product substance restrictions:

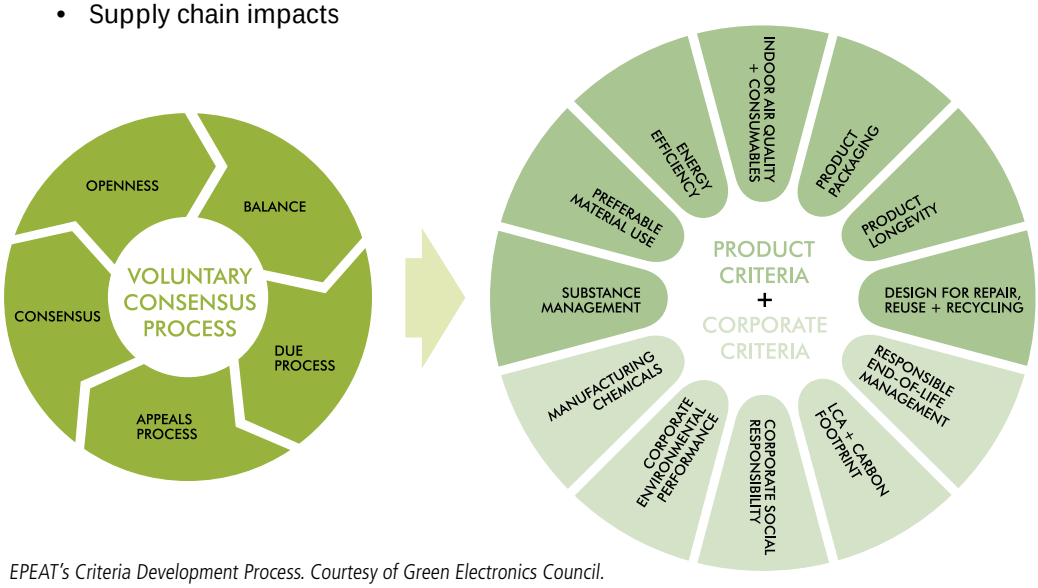
- Apple's Regulated Substances Specification
- Canon's Green Procurement Standards
- Cisco's Controlled Substance Specifications
- Dell's Chemical Use Policy and Guidelines for Management of Manufacturing Process Chemicals
- HP's Material and Chemical Management Policy
- IBM's Engineering Specification
- Lenovo's Engineering Specification
- Microsoft's Responsible Sourcing of Raw Materials Policy
- Panasonic's Chemical Substance Management Rank Guidelines
- Samsung Electronics Standards for Control of Substances Used in Products
- Sony's Controlled Substances SS-00259 for General Use

Voluntary Initiatives

An example of a tool to inform manufacturer procurement policies is GreenScreen® For Safer Chemicals. The globally recognized method identifies hazardous chemicals and safer alternatives. It is used by industry, government and NGOs to inform procurement, product design and development, standards, and policies. In 2016, HP expanded their use of GreenScreen® to assess alternatives for substances used in printing inks and hardware products.[6]

EPEAT (Electronic Product Environmental Assessment Tool) is a trusted source of electronic product ratings, making it easy to select devices that support organizations' IT and sustainability goals. Products are rated against a range of environmental performance criteria covering the lifecycle of a product. This includes:

- Reduction/elimination of environmental sensitive materials
- Materials selection
- Design for end-of-life (repair, reuse and recycling)
- Product longevity/life cycle extension
- Energy conservation
- End-of-life management
- Life cycle assessment and carbon footprint
- Corporate performance
- Packaging
- Supply chain impacts



EPEAT's Criteria Development Process. Courtesy of Green Electronics Council.

Personal computers, displays, imaging equipment, televisions, mobile phones and servers are examples of products registered under EPEAT. Most recently, standards for PC and display devices were updated to include new language on battery life and replacement, chemical restrictions, device repair and energy efficiency. Currently, there are over 1,600 electronic devices registered in Canada with products being continuously added to the registry.[8]

Government of Canada

The Government of Canada includes EPEAT requirements in their purchasing specifications.

Over their lifetime, the 44,100 EPEAT registered electronics purchased by Shared Services Canada in 2016 will result in the following environmental impact reductions:

- Reduce use of materials by 2,660 metric tonnes
- Electricity savings of 7.5 million kWh
- Reduction of 1,330 metric tons of greenhouse gas emissions[7]

Evolution of Materials in Consumer Electronics

Screens from TVs, monitors, and portable PCs are examples of changing material composition in consumer electronics. Launched this year by ProSUM, the Urban Mine Platform presents available data on products put on the market, composition and waste flows of electrical and electronic equipment for all EU 28 Member States plus Switzerland and Norway.[9] If we sized this EU data to the Canadian market, the results show that the amounts of hazardous substances (i.e. lead and cadmium) in screens being returned for recycling have significantly decreased since the mid-2000s (Figure 1). This illustrates a positive outcome in eliminating environmentally sensitive materials in electronics products.

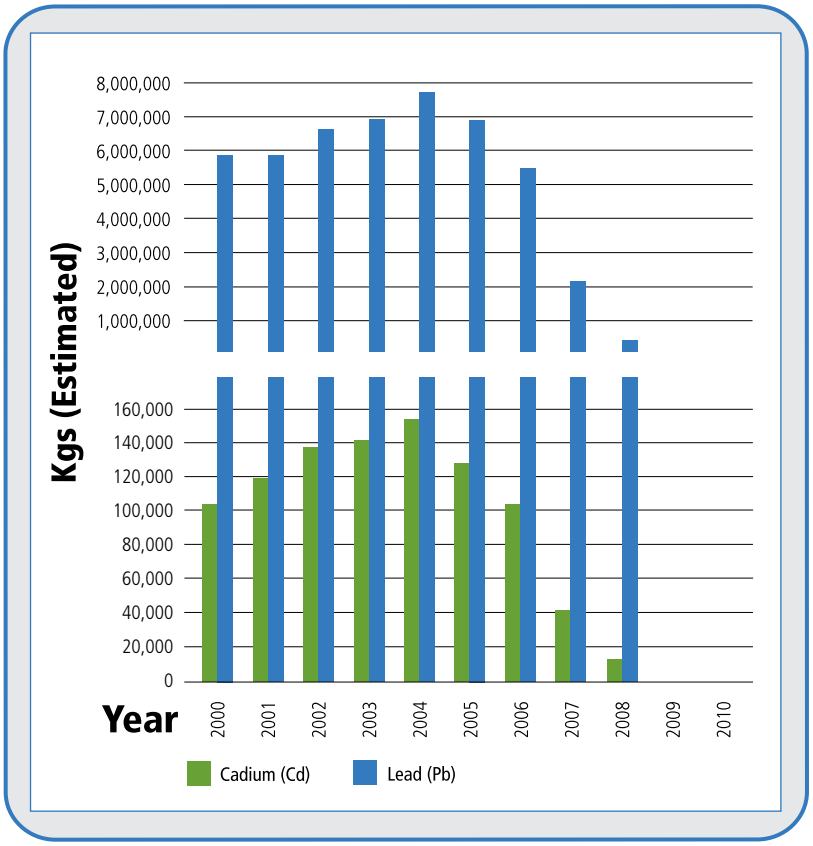


Figure 1: Estimated kgs of lead and cadmium in screens placed on the market in Canada. Extrapolated from EU data (ProSUM Project, 2018).

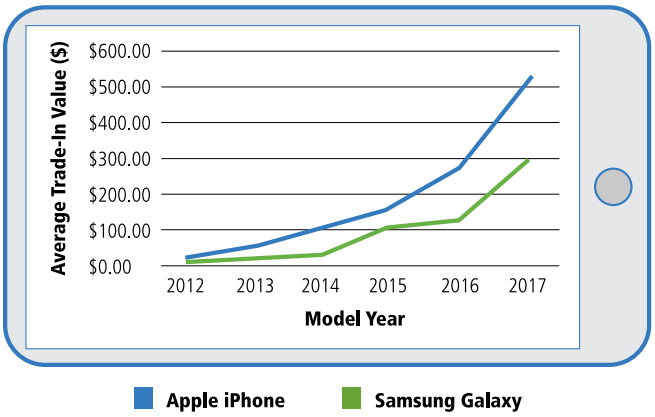
Reuse

Refurbishment Activities

The Microsoft Authorized Refurbisher (MAR) Program allows all types of end-of-life electronics to be recycled for reuse and resale, often benefiting non-profit organizations, schools and homes. In Canada, Microsoft works with 10 approved partners to refurbish PCs or servers and install genuine Microsoft software to make them ready for new owners.[10]

Samsung and iFixit collaborated on the "Galaxy Upcycling" Initiative. The initiative allows users to develop uses for their old Galaxy mobile phones and share the code on the Upcycling website, where other users can download and use these crowdsourced ideas. The Galaxy Upcycling Initiative extends value for devices that might otherwise be forgotten in desk drawers or discarded. Unused Galaxy mobile devices can be turned into an Internet of Things hub, CCTV system, game console, etc.[11]

Trade-In Value of Electronics Devices



Wireless devices (i.e. smartphones, smartwarches, and tablets) hold their value. Old devices are either refurbished and resold into the market, or safely recycled. As shown in Figure 2, devices need to be collected within about three years of use to support a viable reuse market.

Figure 2: Average trade-in value of smartphones. Source: Rogers, Bell, and TELUS Trade-In Values, 2018.[12, 13, 14]

Recycle

Recyclable electronics are often referred to as an "urban mine". The value of this mine is growing as costs fall due to the improvements in recycling efficiency and the learning curve associated with demanufacturing of e-waste materials.

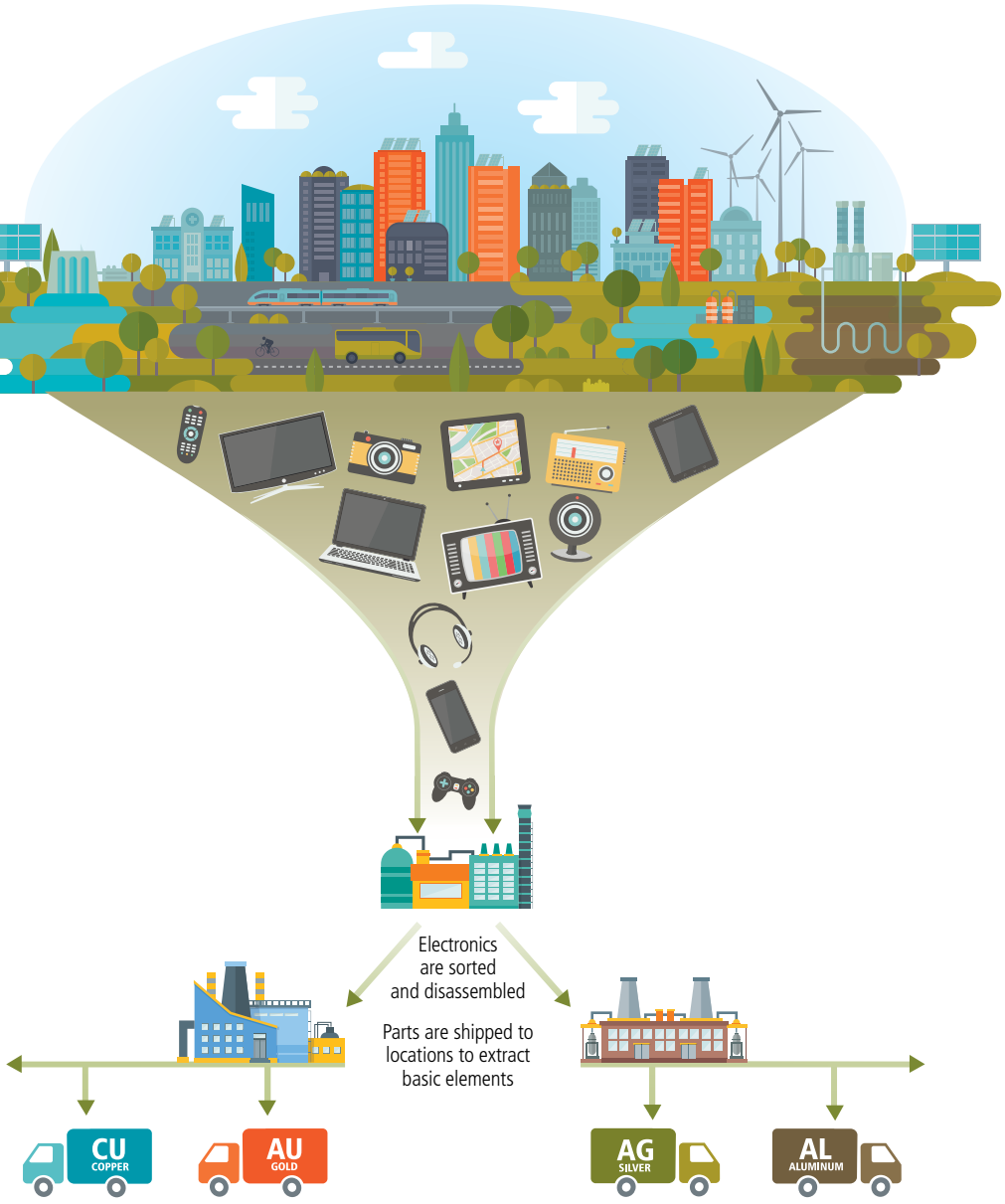
End-of-life electronics contain a host of important materials that can be recovered through responsible recycling, enabling the "urban mine" to provide commodities for new product manufacturing with a much smaller environmental footprint than traditional mining.

A recent study examined the economic benefits of urban mining in China. The findings show that electronics recycling is only cost effective for extraction of key metals such as gold and copper. From 2010 to 2015, the cost to extract copper from CRT TVs went from US$6.60/kg down to US$1.70/kg by 2015, against a market price of US$6/kg. Similarly, the cost of extracting gold from CRT TVs went down from US$8,438/kg to US$1,591/kg, compared to the market price of just under US$4,000/kg.[15]

The study concludes that a government subsidy of US$13 per CRT unit is still required to support a move to urban mining and a circular economy. The cost of disposing of the residues from recycling, due to stricter standards, have risen in China from US$300 in 2005 to US$1,100 per ton in 2015.

With the majority of electronics manufactured in China, these findings are encouraging. They demonstrate the economic feasibility of extracting commodities from end-of-life electronics.

How Urban Mining Works



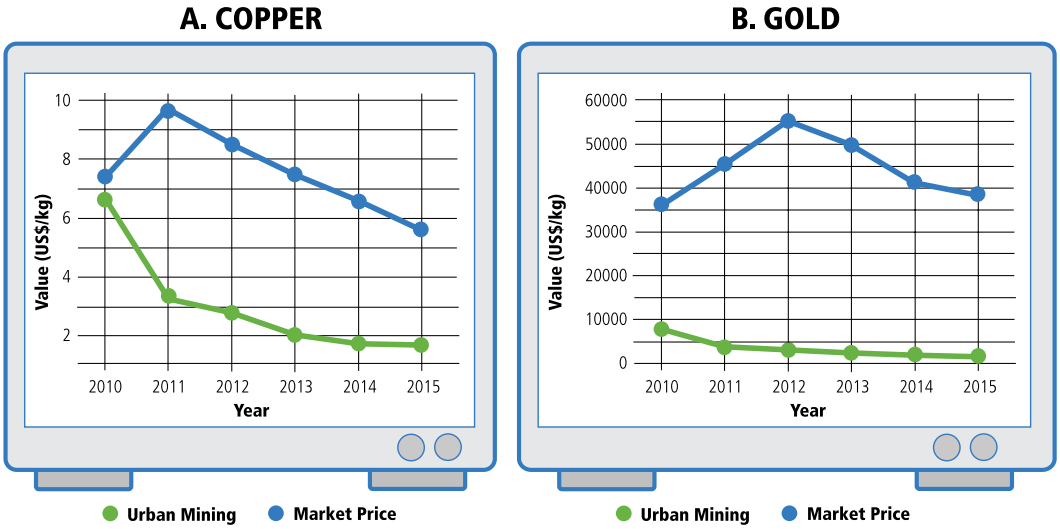


Figure 3: Costs of copper (A) and gold (B) recovered from CRT TVs compared to global market prices.
Source: Zeng, Mathews, and Li, 2018.

Extracting Value from End-of-Life Electronics in Canada

In Canada, mining is one of the country's most important economic sectors. The mining sector's considerable infrastructure makes Canada well placed to extract metals from end-of-life electronics. Most primary end-of-life electronics dismantling and processing occurs in Canada. Primary processing involves dismantling products which are then sent to downstream processors, including mining operations with smelters for extraction of commodities such as lead, copper, gold and silver. These metals are commodities sold into the global marketplace along with their mined equivalents.

Electronic equipment generated by the industrial, commercial and institutional (IC&I) sector is a special case. Business products (e.g. floor standing printers, photocopiers, and multifunctional devices) are often refurbished and sold into secondary markets or harvested for parts.

EPSC believes that to retain the most value from used IC&I equipment, they should be the responsibility of the generator, often working with manufacturer to make decisions on refurbishment and parts harvesting. Otherwise, in a regulated system, these products are shredded for scrap which has less value.

The following table provides a glimpse into how materials embedded in today's electronics are recovered and put back into the manufacturing supply-chain globally.

Recovered Materials	From-Electronics	Primary Processing	Location	Downstream Processing	Location	End-Use
Steel	TVs, Desktop Computers, Laptops	Dismantled, separated and shredded	Canada	Smelting	Canada, USA	Sold globally as commodity
Aluminium	Hard drives, TV and Computer Monitors	Dismantled, separated and shredded	Canada	Smelting	Canada, USA	Sold globally as commodity
Mercury	Laptops, Monitors, TVs	CCFLs (Cold Cathode Fluorescent Lamps) extracted from electronics	Canada	Retorted	USA	Reclaimed elemental mercury
Plastic	TVs, Desktop Printers, Computer Monitors, Computer peripherals	Dismantled, separated, pelletized	Canada	Sorted according to resin type	Canada, Malaysia	Sold globally as commodity
				Processed for energy recovery	USA	Energy recovery
Copper, Gold, Silver, Palladium, Tin	Circuit Boards (from TVs, Desktop Computers, Laptops, Printers, Mobile Phones, etc.)	Dismantled or shredded	Canada	Metal extraction	Canada, Belgium, Japan, Sweden, USA	Sold globally as commodity
Copper	Cables and Wires	Separated	Canada	Smelting	Canada, USA, Belgium, Japan	Sold globally as commodity
Leaded Glass	CRT, TVs, and Computer Monitors	Dismantled and separated	Canada	Cleaned, and processed into cullet	Spain, USA	Leaded glass products (ex.ceramic tiles)
				Smelted for reclaim of lead from the glass Glass to glass processing	Canada, USA	Sold globally as commodity
Glass	TVs, Computer Monitors	Dismantled and separated	Canada	Cleaned, and processed	Canada, USA	Sold to be used in glass products and construction materials (reflective highway paint)
Entire Component	Ink/Toner Cartridges	Cleaned and recondition for reuse	Canada USA	Materials used in new cartridges	Canada, USA	Sold as new or refurbished ink/toner cartridges
		Separated	Canada	Energy recovery	USA	Energy recovery
Cadmium, Lead, Lithium, Cobalt, Zinc, Tin	Batteries	Removed from electronics	Canada	Smelting or chemical extraction of materials	Canada, USA	Sold back into battery manufacturing and some elements used as fertilizers

Although the economic sustainability of electronics recycling and reuse is growing, the following conditions are needed to further encourage a sustainable recycling market in Canada:

Implementing **province-wide landfill bans**. Landfill bans increase material recovery.

Making generators responsible for business equipent due to its intrinsic value for parts harvesting, reuse and refurbishment. Regulatory intervention encourages recycling over reuse.

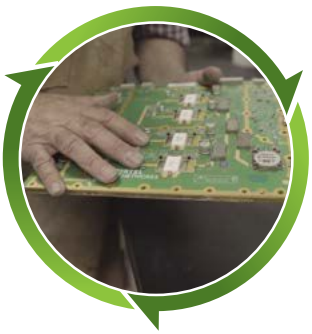
Recognizing **circular economy policies as encouraging a global flow of recycled materials** rather than a Canadian or provincial closed economy.

Closed and Open Loop Recycling Systems

Daisy, Apple's latest innovation in material recovery, can disassemble nine different iPhone models to recover valuable materials that traditional recyclers cannot. Courtesy of Apple Inc.

Apple is challenging themselves to one day end their reliance on mining altogether. To start, Apple is encouraging more customers to recycle their old devices through Apple GiveBack. They are also investing in innovative recycling techniques, like their newest disassembly robot, Daisy, so they can put reclaimed materials to better use in new products. Daisy can take apart up to 200 iPhone devices per hour, removing and sorting the high quality components, so that Apple can recover materials that traditional recyclers can't - and at a higher quality.[16] Created through years of R&D, Daisy incorporates technology based on Apple's learnings from Liam, its first disassembly robot launched in 2016. For every 100,000 iPhone devices, Daisy has the potential to recover:

- Aluminum 1900 kg
- Gold 0.97 kg
- Silver 7.5 kg
- Rare Earth Elements 11 kg
- Tungsten 93 kg
- Copper 710 kg
- Palladium 0.10 kg
- Tin 42 kg
- Cobalt 770 kg
- Tantalum 1.8 kg[17]



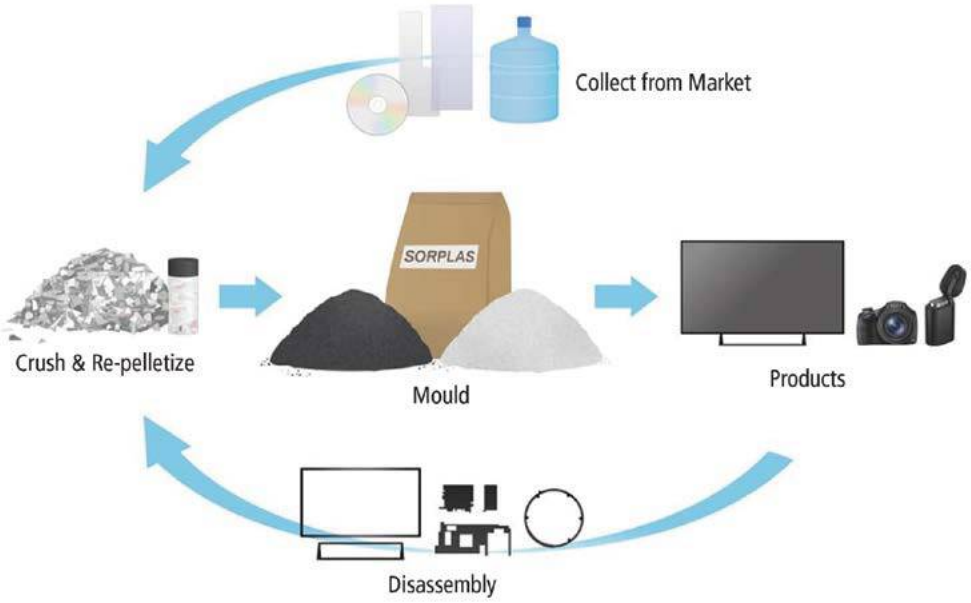
Example of a motherboard used in Dell's Closed Loop Gold Process. Courtesy of Dell Canada.

Dell mines their own recycling stream for raw materials. In the case of gold, Dell's partner, Wistron Green Tech, responsibly extracts gold from motherboards and melts the gold into bars for easy transport to suppliers. A ton of used motherboards has up to 800 times more gold than a ton of gold ore.[18] The initial project could support the creation of millions of new motherboards, the first of which appeared in the Dell Latitude 52851 2-in-1. In addition to the closed loop gold solution, Dell and Nikki Reed unveiled The Circular Collection by Bayou with Love, a jewelry line made from recycled gold recovered by Dell's recycling program. Overall, the gold reclamation process created by Dell in partnership with Wistron has a 99% lower environmental impact than traditionally mined gold.[19, 20]

Dell's closed loop recycled plastics supply chain continues to grow, as well. Since 2014, Dell has used over 24 million pounds of closed loop recycled plastics in over 90 currently shipping products.

HP is purchasing recycled plastic made with raw materials collected in Haiti, for use in their cartridge recycling program. In 2016, HP manufactured more than 3.4 billion HP ink and toner cartridges using more than 88,900 tonnes of recycled content material. This has kept 735 million cartridges, 70 million apparel hangers, and 3.7 billion postconsumer plastic bottles out of landfills, upcycling these materials for continued use.[21]

Sorting bottles for recycling in Haiti. The recycled plastic is used in HP's ink cartridge recycling program. Courtesy of HP Canada Co.



Sony's SORPLAS™ Recycling Process. Courtesy of Sony North America.

Sony is reducing their use of non-renewable resources by developing SORPLAS™, recycled polycarbonate plastics from materials such as optical discs from discarded DVDs and optical sheets used in LCD televisions. The recycled material uses a sulfur-based flame retardant to achieve a highly durable and highly heat-resistant plastic. Use of SORPLAS™ in the BRAVIA KDL-40EX52H LCD TV helped reduce CO2 emissions by nearly 80% during its production as compared to virgin resin.[22]

In Europe, an EU funded project at the Fraunhofer Institute aims to improve the markets for recovered plastics from WEEE (waste electronic and electronic equipment). To enhance the use of recycled plastics in new applications, the PolyCE (Post-Consumer High-Tech Recycled Polymers for a Circular Economy) will:

- develop a harmonized set of technical requirements addressing the value chain
- create a grade system for recycled plastics based on their material properties and final application
- validate the technical and economic feasibility, as well as environment benefits
- produce guidelines for designing new electronics with recycled plastics

The project intends to be scaled up by involving target cites and their green procurement initiatives.[23] This initiative has the potential to positively impact plastics recycling world wide, including Canada.

Electronics Recycling in Canada (Through Regulated Recycling Programs)
Amount of electronics diverted in 2016: **124,751 tonnes**
Amount collected since launch until end of 2016: **920,679 tonnes**
Annual cost to consumers to recycle electronics in 2016 (via EHF): **$124 million**

Product Design for Recyclability

For more efficient recycling, electronics manufacturers are working to achieve easier disassembly and sorting of their products.

Panasonic's material indication of resin component to facilitate sorting. Courtesy of Panasonic Corporation.

LENOVO	Lenovo products are designed to minimize the types of plastics they contain, and avoid contamination of plastics by paints, glues or welded connections. Tools needed for disassembly to subsystem levels are also universally available.[24]
PANASONIC	Panasonic works on designing products that minimize fixed methods, such as welding and swaging that are difficult to undo. In addition, materials used for resin components are indicated to facilitate sorting.[25]
SAMSUNG	Samsung's LED Smart TV (SUHD UE65KS9000) features a screw-less design for higher recyclability.[26]

Recycled Materials in Electronic Devices

Manufacturers are committed to scaling up the use of recycled material content in their products.

Cisco IP Phone 7800 Series. Courtesy of Cisco Systems, Inc.

CISCO	The Cisco IP Phone 7800 Series was released using a minimum of 35 percent post-consumer plastic in seven of its unique plastic components.[27]
DELL	In 2018 fiscal year, Dell used 7031 tonnes of recycled plastics in their products. 4717 tonnes came from closed-loop efforts and 1814 tonnes came from post-consumer recycled content (sourced from water bottles, etc.). Dell increased their use of recycled carbon fiber across Dell LatitudeTM products, using 499 tonnes in FY18. Dell also used 5 tonnes of recycled Dell EMC closed-loop process and 2 kg of gold from our closed-loop gold initiative.
SONY	In 2016 fiscal year, virgin plastic used per product was down 6.9% from the fiscal 2013 level. The main factors in the reduction were the increased use of recycled plastics in televisions, media players and camcorders and reductions in the size and weight of game consoles.[28]

Packaging Innovation

Package design provides opportunities to reduce materials used and improve energy efficiency. Manufacturers continue to increase the use of recycled materials in packaging.

Product packaging of Apple's iPhone 7 compared to the previous generation. Courtesy of Apple Inc.

Apple's packaging of iPhone 7 uses 84 percent less plastic than the previous-generation iPhone packaging and contains 60 percent recycled content.[29]

Cisco's Make It Green program is an initiative to limit the waste and costs associated with products and packaging while reducing carbon emissions. Through Make It Green, approximately 2,064 cumulative metric tonnes of material and 21,738 cumulative metric tonnes of CO2 emissions were avoided in 2017 fiscal year.[30]

Dell's packaging material made from recycled ocean plastics. Courtesy of Dell Canada.

Dell developed a new packaging tray made from a blend of recycled ocean plastics (25 percent) and other post-consumer recycled, high-density polyethylene (HDPE) plastics (75 percent). Dell is using the tray to protect XPS 13 2-in-1 laptop shipments. The trays are shipping globally and the initial run will keep 7.3 tonnes of plastics out of the oceans. Their aim is to scale the project to 73 tonnes by 2025 and they will continue to look for ways to use the material for both packaging and products in the future.

In addition, Dell, in partnership with The Lonely Whale Foundation, helped convene Next Wave, an open-source initiative that brings leading technology and consumer-focused companies together to develop a commercial-scale ocean-bound plastics and nylon supply chain. Companies from various sectors have agreed to test integration of ocean-bound materials into products and to reduce source plastic across their operations and supply chains. The group anticipates that together they will divert more than 1360 tonnes of plastic and nylon-based fishing gear from entering the ocean within 5 years – the equivalent of keeping 66 million water bottles from washing out to sea.

Microsoft reduced package weight by an average of 17 percent through a combination of right-sizing packaging to the product and introducing new lightweight materials.[31]

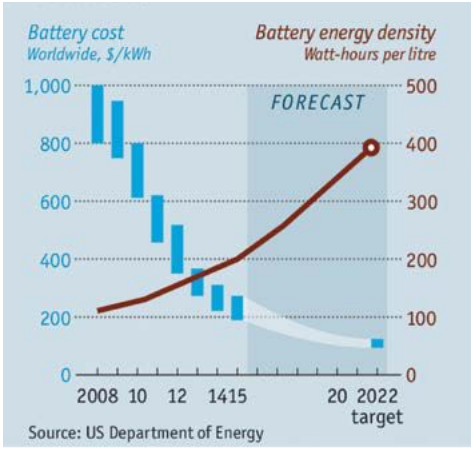


Figure 4: Trends in battery cost and energy density of lithium-ion cells. Source: The Economist, 2017.

Battery Innovation

Battery technology is changing, resulting in better performance and extended use of life. In general, the cost of lithium-ion cells (the basic components of batteries) is going down, while power density is improving, as shown in Figure 4.[32] With a growing market, processors are maximizing the recovery of cobalt and other critical metals from lithium-ion batteries, while reducing the demand for virgin materials from mining.

Lithium-ion technology in laptops enable thinner systems and durability. Lenovo Longevity Battery Technology extends notebook battery cycle life through key technologies, including:

- Increased use of lithium polymer cells: used in notebooks and tablets with embedded batteries, these cells typically provide longer life cycles than lithium-ion cylindrical cells
- Longer lifespan batteries: many Lenovo embedded batteries are designed to last two to three times longer than standard batteries
- Dual mode charging algorithms: these technologies are used on most notebook batteries and adjust charge voltage and current over time to prolong the battery's lifespan
- Field updateable battery firmware: customers can download a firmware update utility which allows them to apply firmware fixes to batteries in service, eliminating the need to replace batteries due to firmware problems[33]

Newest Technology	Older Technology
	
Lenovo ThinkPad X1 Carbon (6th Gen)	**IBM ThinkPad 700C**
Model year: 2018 **Battery type:** Integrated Li-Ion **Battery life:** up to 15 hours **Weight:** 1.1 kg **Environment standards:** EPEAT Gold, ENERGY STAR®	**Model year:** 1992 **Battery type:** Nickel hydride **Battery life:** 2 to 4 hours **Weight:** 3.4 kg **Environment standards:** n/a[34]

Standard batteries (e.g. double-A batteries) used to power electronic devices are often discarded after a single use. Advancements in technology have resulted in longer-lasting batteries and less waste. Panasonic's eneloop rechargeable batteries combine the performance and convenience of single use batteries with the cost-efficiency of rechargeable nickel-metal hybrid technology. Panasonic eneloop batteries can be reused up to 2,100 times, this is equivalent to 8,400 single use batteries.[35]

102 grams | 2,100 charges | 189.8Kg or 429 lbs

Product Energy Use

EPSC members support federal and provincial harmonization of energy efficiency standards. Continued improvements in technology have resulted in more energy efficient electronic devices.

Product Energy Use Improvements

APPLE	MacBook Pro consumes 61 percent less energy than the original MacBook Pro with Retina display.[36]
IBM	The IBM OpenPOWER S822LC server has an 80 PLUS Platinum certified power supply, one grade above ENERGY STAR requirements and two grades above requirements established pursuant to EU Directive 2009/125/EC, which sets eco-design requirements for computer servers.[37]
MICROSOFT	The average energy consumption for the Surface Pro has been reduced from 25.9 kilowatt-hours per year to 18.3 with the current 2017 Surface Pro.[38]

Microsoft 2017 Surface Pro. Courtesy of Microsoft Corporation.

ENERGY STAR®

The ENERGY STAR is the mark of high energy efficient products in Canada. The label makes it easy to identify the best energy performers on the market. Certified products meet strict technical specification for energy performance. Electronics manufacturers have contributed to the success of the voluntary ENERGY STAR program. This year, Samsung Electronics Canada was awarded the 2017 ENERGY STAR Manufacturer of the Year Award for advancing energy efficiency. In 2016, 99% of all televisions sold by Samsung were ENERGY STAR certified.[39]

Conserving Resources in Manufacturing

Manufacturing is a highly-energy intensive process, adding to the overall energy and water footprint of electronics devices. Responsible manufacturers are identifying opportunities to reduce energy and water consumption.

Canon promotes the recycling of water resources. The Kitsuki Plant of Oita Canon Materials Inc. employs a closed wastewater system that discharges nothing but rainwater.

IBM formalized its energy conservation and management program in 1974. From 1990 through 2016, IBM conserved 7.2 million MWh of electricity, avoiding 4.4 million metric tons of CO2 emissions.[40]

Lenovo's photovoltaic solar panel installation at the Lenovo-Compal facility in Hefei, China, will save approximately 3,900 metric tons of carbon emissions annually. Lenovo's other renewable energy installations include solar hot water generation facilities in Beijing and Huiyang and solar electric generation plants in Beijing and Shanghai. The current solar capacity of all these projects is over 5 MW with emission reduction potential of over 5,000 metric tons of carbon emissions annually.[41]

Previous Design for Environment Reports

2017

2016

2015

2014

2013

2012

2011

2009

2006

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About EPSC

EPSC 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 standards for the responsible handling of end-of life electronics.

Responsible electronics manufacturers are members of EPSC

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- Cisco Systems Inc.
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