

DESIGN for ENVIRONMENT 2020 REPORT



Message from Electronics Product Stewardship Canada (EPSC)

Canadians continue to value and make technology a key part of their daily lives: Canadians' most owned technology devices include televisions (owned by 93% of Canadian households), smartphones (85%) and laptops (74%); and in the year ahead, 30% of Canadians households plan to buy a smartphone, 26% expect to purchase either wired or wireless earbuds and 17% expect to buy a TV. ¹

Electronics Product Stewardship Canada members are leading electronics manufacturers who continue to advance the sustainability of their products and operations. This includes the entire lifecycle from design to material sourcing, product performance, and responsible end of life management.

Consumer electronics have become multi-functional, thinner, lighter, and faster over time to meet consumer demands for functionality and portability. Increasingly, less physical hardware is needed with the growth of virtual services such as streaming and cloud computing.

We are pleased to release our 12th Design for Environment Report, which outlines the progress electronics manufacturers have made in moving towards a more sustainable approach to the selection of materials, manufacturing and design for the use of electronics.

This year's report comes out at a time when the world faces a global pandemic. EPSC members products have provided the digital capability to allow businesses and employees to securely work from home and students to study online. It has also allowed friends and families to stay connected, as we learn to socially and physically distance ourselves from one another to help stop the spread of COVID-19. These virtual connections have never been more important and we are proud of the technological innovations we provide to help people stay connected.

We hope that the information contained in this report is useful in understanding how manufacturers design for the environment and how we manufacture, design for use, and responsibly manage electronics when discarded by consumers.



Jeff Van Damme

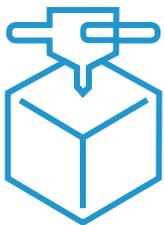
Chair of the EPSC Board

(Samsung Electronics
Canada Inc.)



Shelagh Kerr

President and CEO
EPSC



HP's 3D printing is proving an invaluable resource in the rush to fight COVID 19. HP has stepped up by making 3D designs for personal protective equipment, ventilator parts and hands-free door openers.²

Technology for the Needs of our Society

2020's pandemic response has been greatly enabled by the use of technology to help us maintain social distancing at work, study, home and in our communities.

Consumer electronics manufacturers have stepped up with new technologies and programs to assist Canadians:

HP's initial batch of 3D applications being validated and finalized for industrial production includes face masks, face shields, mask adjusters, nasal swabs, hands-free door openers, and respirator parts. The design specifications of many of these applications will be offered for anyone to download and print, anywhere in the world.

HP is enlisting their global network of manufacturing partners so that any hospital worldwide can access 3D-printed parts that meet crucial quality and safety standards. HP's 3D printing factories are increasing production to meet the most urgent needs.

Apple has launched a tool that reveals changes in the travel behaviour of people who use its Maps app to help with social distancing.³

Apple also provides a way to export its records as a spreadsheet, making it easy for researchers and the media to make use of the data within their own COVID 19 models. This data will provide governments with more reassurance that people are complying with the lockdown restrictions.

Cisco's Connected North initiative is empowering youth in Canada's Indigenous communities. Statistics Canada has found that indigenous youth graduate from high school at half the rate of their non-indigenous peers.

Launched in 2014 with one school in Iqaluit, the program now serves 10,000 indigenous students in 42 remote schools across the Yukon, Northwest Territories, Nunavut, Saskatchewan, BC, Manitoba, Ontario and Alberta. The success of the program resulted in partnerships to create scale. The charity TakingITGlobal now manages the program with support from 60 funding partners. Northern students can now have the same learning opportunities as students in southern Canada (CompTIA World, Fall 2019)

Panasonic's core mission is "contribute to society." This enduring principle guides the company today as it faces the challenges of responding to COVID-19. Industries served by Panasonic, such as manufacturing, computing devices for public sector and food retail, are deemed "essential" to ensuring reliability of the supply chain and equipping first responders.

Panasonic is working with its customer, Phillips Healthcare, to supply backup batteries for their ventilator production surge. In addition, Panasonic is providing its Ziaino high-performance air purification and sterilization equipment to medical institutions, plus its autonomous sterilization robot HOSPI-mist, which can be deployed in hospitals to transport medicine and medical samples while spraying disinfectants to offer a self-manuevering sterilization solution.

EPSC members are making their computing technologies available to governments and researchers to speed up the search for a vaccine or treatment.

We are in this together.



Connected North

Cisco Canada's Connected North initiative delivers immersive and interactive virtual education as well as mental health and wellness programming via Cisco Tele Presence technology.

Reducing Use of New Resources in Electronics to Reduce Waste

EPSC members incorporate environmental design principles into their products, packaging and manufacturing processes in response to societal concerns about limiting the impact of resource use on our environment.

Electronic products are designed for functionality and, increasingly, for durability and compatibility with older models and software.

Plastics Reduction

Electronic products manufacturers continue to reduce the use of virgin plastics and increase the use of recycled plastics and other materials, collaborating with supply chain partners.

Research shows that using recycled plastic in electronic products could reduce the environmental impact of a single product by over 20%, while closed-loop systems generate significant environmental benefits.⁴

The federal government has announced that it is taking action to reduce plastics, working with provinces, territories, businesses and the Canadian Council of Ministers of the Environment to develop an action plan to implement the Canada-wide Strategy on Zero Plastic Waste to support evidence-based decision-making and innovative approaches to sustainable plastics production, recycling, and recovery.⁵

Dell's closed-loop plastic system has resulted in avoided environmental costs of \$2.26 million annually compared to the use of virgin ABS⁶ plastic.⁷

Dell used 42.6 million kilograms of recycled-content plastic and other sustainable materials in its products in 2018, representing a 31% increase compared to the previous year. This increase can be attributed to Dell's efforts to scale the reuse of plastics from used electronics: 6.2 million kilograms came from closed-loop efforts and 3.4 million kilograms came from post-consumer recycled content. Dell also announced that they will use 100% recycled or renewable material in all their packaging by 2030.⁸

HP increased the recycled content plastic in their ENVY photo printer models to 20-30% by weight; HP Tango is now made with more than 30% closed-loop recycled plastic and; the HP T1700, Z6, and Z9 DesignJet Printer series contains more than 33% recycled content plastic. HP's closed-loop recycling program uses plastic from recycled Original HP cartridges (plus recycled bottles and hangers) to create new Original HP cartridges, with the majority of their ink cartridges containing 45-70% post-consumer recycled content.

IBM developed a new approach to recycling plastics called VolCat (short for volatile catalyst), which turns waste polyethylene terephthalate (PET) into a substance ready to be fed directly into new plastic manufacturing. The process – which turns used plastic bottles into piles of a pure material that can be used to manufacture new plastic products, replacing petroleum-based feedstocks – is tolerant of contamination with dirt and other materials, which has been one of the roadblocks to large-scale recycling.⁹

IBM's new VolCat technology¹⁰



Dell used 42.6 million kilograms of recycled-content plastic and other sustainable materials in its products in 2018.

SONY

One Blue Ocean Project

Sony launched the [One Blue Ocean Project](#), an initiative to reduce pollution by ocean plastics and promote reduced use of plastics. In 2018, Sony reduced plastic waste generation by 1,080 tonnes.



nextwave

Dell Inc. and **Lonely Whale** convened a cross-industry group to address marine litter in 2017. NextWave has grown to include 10 member companies and quickly risen to become a thought leader in ocean-bound plastic and circular economy innovation.

Samsung's Galaxy S10, launched in 2019, uses bio-based plastics, which are derived from renewable biomass sources, such as vegetable oils and corn starch. Its earjack housing contains 29% biobased plastics, while the Galaxy S10e's front deco part contains 37% biobased plastics.¹¹

Sony developed new recycled packaging for its aibo, a robotic pet product, consisting of a felt package produced from 50% recycled PET plastic bottles. The plastic bottles are collected, shredded, added 50-50 to new polyethylene terephthalate "wool" and woven into a 3-mm thick felt sheet, which is supplied in rolls and moulded into the new package. Sony also launched the [One Blue Ocean Project](#)¹², an initiative to reduce pollution by ocean plastics and promote reduced use of plastics. In 2018, Sony reduced its plastic waste generation by 1,080 tonnes.¹³

About NextWave Plastics¹⁴

NextWave Plastics was [launched](#) in 2017 by **Dell Inc.** and **Lonely Whale**, who had previously partnered to educate companies and consumers on the dangers of ocean plastics through the [Lonely Whale VR experience](#)¹⁵. It is a consortium of multinational technology and consumer brands committed to working together to decrease the volume of plastic litter entering the ocean by developing the first global network of ocean-bound plastic supply chains. Member companies pursue this vision through the development of commercially viable and operational supply chains that integrate non-virgin plastic material into products and packaging.

Since its launch, NextWave member companies, **including HP**, have developed product use cases to showcase the viability of integrating into their supply chains ocean-bound plastics found in areas such as Indonesia, Chile, Philippines, Haiti and Denmark.

NextWave has grown to include 10 member companies and quickly risen to become a thought leader in ocean-bound plastic and circular economy innovation. Member companies are committed to diverting a minimum of 25,000 metric tonnes of plastic — the equivalent of 1.2 billion single-use plastic water bottles — from entering the ocean by the end of 2025. The goal is in alignment with UN Sustainable Development Goal (SDG) 14.1, to conserve and sustainably use the oceans, seas, and other marine resources for sustainable development by preventing and significantly reducing marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution.



Panasonic developed a polypropylene (PP) resin containing plant-derived cellulose fiber.¹⁶ The durable plastic is comprised of 55% cellulose fibers, an insoluble substance obtained from the bark, wood or leaves of plants, or from other plant-based material.¹⁷

Apple has focused on using less plastic through material efficiency and, for the plastic they do use, they seek out renewable or recycled alternatives. They re-designed the way plastic was injected into the mold of a high-volume part in its iPhone XS and iPhone XR, cutting the scrap produced by one-third. They have identified recycled alternatives for 24 different grades of plastic, allowing them to use an average of 38% recycled plastic across 82 components for products released this year. In its packaging, Apple is working to eliminate the need for plastics altogether and has reduced the plastic in its U.S. product packaging by 48%.¹⁸

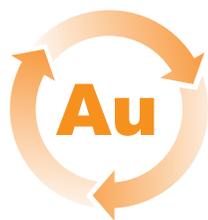
TCL has been proactively promoting minimal use of raw materials and reducing environmental pollution during production. Plastic optical granules in TV light guiding plates are made from PET material. Maintaining the same optical capacity, TCL successfully developed a two-in-one and three-in-one compound guiding plate that not only reduces the quantity of plastic granules per light guiding plate but also reduces the use of emissions generated from the refining process. The thinner granule design in turn **reduces the use of PET raw materials by 50%**.¹⁹

Reducing the Use of Other Materials

Lenovo

Since 2017, Lenovo has used over 2,500 metric tons of closed loop materials that may have otherwise been landfilled.

Lenovo expanded its use of post-consumer recycled content, using closed loop materials sourced from end-of-life information technology equipment and products, to a total of 21 products in 2018/19, a significant increase from 2 products in the previous reporting year. Since 2017, Lenovo has used over 2,500 metric tons of closed loop materials that may have otherwise been landfilled.²⁰



***Dell** expanded its closed-loop recycling program from plastics to include precious metals with the introduction of its closed-loop gold recycling program, a pioneering initiative to reclaim gold from used electronics.*

Dell expanded its closed-loop-recycling program from plastics to include precious metals with the introduction of its closed loop gold recycling program, a pioneering initiative to reclaim gold from used electronics. This reduces demand for mining of gold ore, along with the social and environmental costs associated with it. Dell's gold recycling process used in its supply chain does 99% less environmental damage than virgin mining operations. Dell became the first PC manufacturer to use recycled gold from e-waste in its products, debuting with the Dell Latitude™ 5285 2-in-1 at the Consumer Electronics Show in January 2018, which shipped to customers in the second quarter of 2019. Dell is exploring options to expand the use of closed-loop gold in other parts of its portfolio.²¹

Apple developed a new alloy enabling them to produce the first 100% recycled aluminum. In fall 2018, Apple introduced MacBook Air and Mac mini models with 100% recycled aluminum enclosures. In 2019, their efforts will allow Apple to avoid mining of more than 900,000 metric tonnes of aluminum-bearing bauxite.²²

Reducing Substances of Concern

EPSC members continue to actively remove substances of concern from electronics, taking steps to reduce, substitute and eliminate the use of these substances.

Dell phased out six substances of concern in 2019, including several phthalates, from products and their components. They also began requiring their suppliers to report their use of six non-regulated endocrine-disrupting chemicals. They continue to voluntarily avoid substances if reasonable scientific grounds indicate they could be harmful to humans or the environment. Dell has restricted the use of four phthalates (DEHP, BBP, DBP and DIBP) in all newly designed products since January 2015. This is over four years ahead of the RoHS (the European Union's Restriction on Hazardous Substances in electrical equipment) deadline of July 22, 2019.²³

Lenovo has made significant progress in phasing out halogen-containing additives in many commodities across several product lines, including: all plastic enclosures, most components and connectors (with the exception of printed board laminates); all mechanical plastic parts such as product covers, housings and bezels; many hard disk drives, optical disk drives, solid state drives; LCD screens; memory, CPUs, chipsets and communication cards and; other commodities with offerings that meet the iNEMI definition of low halogen.²⁴

Canon manages chemical substances in products and those used in manufacturing processes to prevent environmental and health impacts. Total emissions of controlled chemical substances in 2018 amounted to 587 tonnes, a decrease of 16 tonnes from the previous year, which was achieved through activities to reduce chemical substances used in the production process.²⁵

Substances of Concern Removed from End-of-Life Electronics Recycled in Canada²⁶

Substances such as lead, mercury, cadmium, beryllium and antimony are removed from products returned for recycling. The following substances were removed and safely managed from a variety of returned electronic products.

Material	Source	2018
Pb Lead	Circuit boards, cathode ray tubes, TVs, monitors, CPUs, laptops, printers	2547.02 (tonnes)
Hg Mercury	Batteries – general; mercury lamp	2.68 (kgs)
Cd Cadmium	Circuit boards, cathode ray tubes, insulated wire, TVs, monitors, CPUs	37.21 (kgs)
Be Beryllium	Circuit boards, TVs, monitors	108.79 (kgs)
Sb Antimony	Circuit board, CPUs, laptops, printers	12.17 (tonnes)



The International Electronics Manufacturing Initiative (iNEMI) is a not-for-profit, highly efficient R&D consortium of approximately 90 leading electronics manufacturers, suppliers, associations, government agencies and universities.

REUSE

Used Toner Cartridge Collection Volume (Cumulative)



Canon's Toner Cartridge Collection and Recycling Program has achieved a cumulative reduction in the use of new resources of approximately 285,000 tonnes.

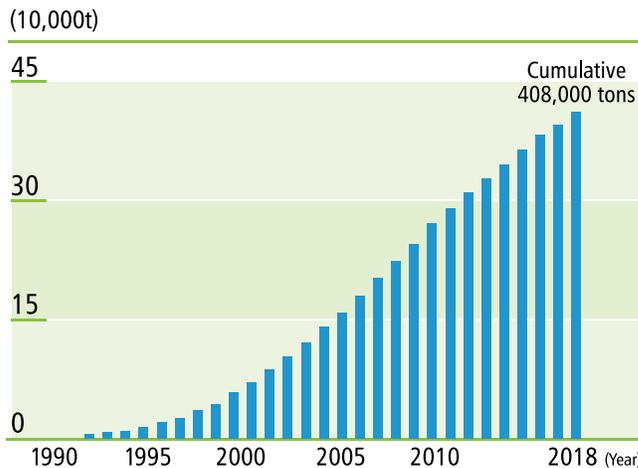


Figure 1 - Canon's Used Toner Cartridge Collection Volume

Canon's Toner Cartridge Collection and Recycling Program has achieved a cumulative reduction in the use of new resources of approximately 285,000 tonnes. Returned used toner cartridges are brought to Canon recycling sites, where they are sorted and the reusable parts picked out and reused in new products. The primary material of toner cartridges is the high-impact polystyrene (HIPS), which can be used repeatedly to make new toner cartridges, a unique feature of Canon's closed-loop recycling process.²⁷

Durability, Repair and Reuse

When a TV, computer or phone requires repair, consumers have a variety of options, including using a manufacturer's authorized repair network, which includes independent local repair service providers as well as mail-in and in-house repair options. Manufacturer authorized repair networks provide customers with assurance that their products are serviced by properly trained and vetted repair professionals with the necessary skills to safely and reliably repair electronic products without compromising consumer privacy or sensitive data, while maintaining the integrity of the product.

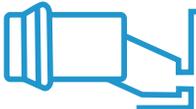
Some types of repairs can be extremely complicated and, in some cases, dangerous to perform for those without proper training and tools. It is particularly important that products containing high-energy lithium ion batteries are repaired only by trained professionals who understand the hazards associated with breakage of these batteries.

Authorized repair networks not only include training requirements, but also ensure that only the correct parts and procedures will be used, thus ensuring repairs are completed safely and securely to help protect against unauthorized access to consumer data.

Protecting proprietary information

Manufacturers make significant investments in the development of products and services, so the protection of intellectual property is a legitimate and important aspect of sustaining the health of the vibrant and innovative technology industry.

Lenovo's Longevity Battery Technology extends notebook battery cycle life through increased use of lithium polymer cells, which typically provides longer life cycles than lithium ion cylindrical cells. They also offer updateable battery firmware, which provides fixes to batteries in service.²⁸



Tips from Lenovo to extend the life of batteries in their laptops:

- 1. Reduce LCD brightness level.** The display is one of the largest users of battery power. Save big on battery life by turning the brightness level down to the lowest comfortable level.
- 2. Unplug unneeded devices.** To save battery life, remove other devices like phones or headphones that are charging. When not using the laptop, but a power source is needed, charge other devices from the notebook as long as it is powered on and unlocked.
- 3. Turn off Bluetooth.** If not using this feature, disable the feature to avoid draining the laptop battery.
- 4. Shut down or hibernate the laptop rather than using standby** if there are no plans to use the laptop for a while. Standby continues to drain energy to keep the laptop ready to go when the cover is opened.
- 5. Use the power management settings on the computer.** In Windows, click [Power Options under Control Panel](#)²⁹. For systems preloaded with [Energy Management, OneKey Optimizer or Lenovo settings](#)³⁰ (preloaded or downloaded from Windows store), it is strongly recommended to select Optimize for Battery Lifespan mode or Conservation Mode and keep the AC adapter connected all the time. This mode will enable the battery to be fully charged to 80% or 60% of its design capacity.

HP builds products that are easy to repair and upgrade to extend their useful life.

HP used more than 21,250 tonnes of recycled plastic in their products and set a new industry-leading goal to use 30% post-consumer recycled content plastics in their printers, supplies, and personal systems by 2025. HP's Elite x2 1013 G3 tablet has a repairability rating of 9 out of 10, and their EliteBook 800 G5 Business Notebook received a 10 out of 10 repairability score. HP repaired 4.34 million units of hardware and reused/remarketed 1.25 million units of hardware in 2018.³¹



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- HP set a goal to use 60% renewable electricity in its global operations by 2025, already having reached an interim target of 40%.
- HP has sourced about 716,000 pounds of ocean-bound plastic bottles (equal to roughly 25 million bottles) to make Original HP ink cartridges and hardware, including the EliteDisplay E273d—the world's first display with ocean-bound plastic material.

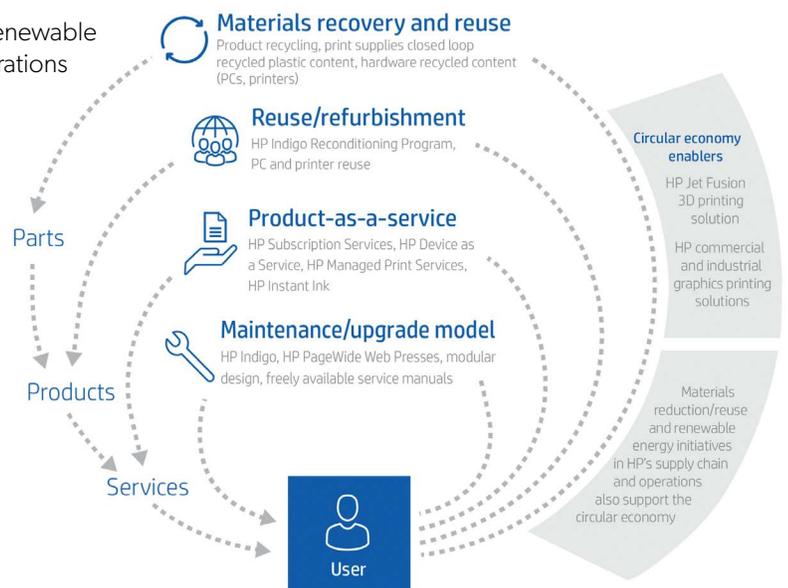


Figure 2 - HP Reuse and Resale

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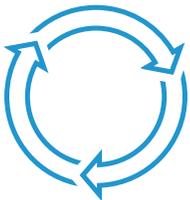


Samsung's Galaxy Upcycling program received the Environmental Leader Award from the US Environmental Protection Agency in May 2018.

Samsung has developed innovative ways to reuse old Galaxy mobile devices with its Galaxy Upcycling program³², which received the Environmental Leader Award from the US Environmental Protection Agency in May 2018.³³ Using Internet of Things (IoT) methodologies – design philosophies that connect everyday objects for increased efficiency and data sharing – the program turns Galaxy devices into other products.³⁴



Samsung upcycling speaker used for Galaxy smartphone



Apple programs directed 7,860,000 of devices to new users worldwide in 2018.

Apple offers a network of Apple Store locations and Apple Authorized Service Providers to provide safe, high-quality repairs. While Apple Trade In allows consumers to exchange their old device for credit so that it can be reused by a new owner. Through these programs, Apple directed 7,860,000 devices to new users worldwide in 2018.³⁵

HP's innovative 3D printing technology has the potential to revolutionize manufacturing and transform supply chains by providing on-demand, more localized means of production. HP Jet Fusion 3D printers enable material reusability of up to 80%, which will reduce the environmental impact of producing finished parts.





The circular economy transition requires leadership through the entire economy, including governments, business, and civil society. PACE convenes a global leadership group committed to advancing this transition and working together to overcome specific barriers to progress.

Cisco announced a 100% product return pledge as part of PACE ([Platform for Accelerating the Circular Economy](#))³⁶, which includes offering comprehensive warranty, replacement, service and repair for all products to extend useful product lifetime and minimize obsolescence and; repurposing returned product, subsystems, components and commodities.

PACE is a public-private collaboration mechanism and project accelerator dedicated to bringing about the circular economy at speed and scale. It brings together a coalition of more than 70 leaders and is co chaired by the heads of Royal Philips and the Global Environment Facility. It was initiated at the World Economic Forum and is currently hosted by the World Resources Institute.

By 2025, Cisco is committing:

1. To reduce its foam packaging use by 75%, as measured by weight (FY2019 base year)
2. To improve product packaging efficiency by 50%, as measured by package volume per weight of product (FY2019 base year)
3. That 70% of Cisco's manufacturing suppliers by spend will achieve a "zero waste" diversion rate at one or more site(s)

In 2018, Cisco's Refurbish, resell, and reuse rate was 31%.³⁷



Dell has used 25,809,406 kilograms of post-consumer, recycled-content plastics from sources such as beverage bottles and CD cases in hundreds of product models since 2014.



The Capital Equipment Pledge

At the World Economic Forum Annual Meeting in 2018, as a member of the Platform for Accelerating the Circular Economy (PACE), Cisco announced its commitment to the **Capital Equipment Pledge** to direct used materials to become new inputs for production. Cisco's pledge is:

100% Product Return

- Provide product return pickup and transport at no cost for any customer worldwide upon request
- Establish alternative commercial models that promote product return, including purchase trade-in, return credit, leasing, and product-as-a-service
- Offer comprehensive warranty, replacement, service, and repair for all products to extend useful product lifetime and minimize obsolescence
- Repurpose returned product, subsystems, components, and commodities, including a limited amount of closed-loop return to new product manufacturing

Dell is driving circular principles deeper into its supply chain and operations, and more broadly into new product categories, keeping materials in use for as long as possible, maximizing their value and reducing waste. Dell uses open-loop sources of plastics and has used 25,809,406 kilograms of post-consumer, recycled-content plastics from sources such as beverage bottles and CD cases in hundreds of product models since 2014.

Dell used 907,185 kilograms of reclaimed carbon fiber from the aerospace industry, helping make their mobility products stronger, lighter and thinner. Through Dell's takeback programs, they are extracting rare earth oxides and reforming them into new magnets for Seagate hard drives; as part of a 2019 pilot program, they used reformed drives in select Dell Latitude 5400 and 5500 laptops. Dell applied a process that uses recycled polyvinyl butyral (rPVB) from car windshields to create the protective coating for laptop bags and backpacks. Dell's continuous search to use recovered materials instead of raw materials is a key part of their innovative circular material use.³⁸



On Earth Day 2019, Dell, Teleplan and Seagate announced the successful introduction of the industry's first closed-loop process for recovering rare-earth magnets.

Dell: Accelerating the Circular Economy with Rare Earths Minerals Pilot

Electronic devices that use magnets in hard disk drives built from rare-earth metals, such as Neodymium, need to be recycled.

Businesses seeking to build a transparent supply chain, who try to hold their suppliers to a high standard when purchasing rare earth metals, can face a complicated process of checking and trusting suppliers. Finding sources other than mines for the needed metals is a priority. Mining end-of-life IT storage equipment and hard disk drives for rare-earth oxides, then using them to augment supply and buffer market volatility, avoids these impacts.

Based on the success of past closed-loop efforts, a cross-functional team from Dell, backed by executives, set out to find a solution. As the project progressed, Dell approached IT asset disposition partner Teleplan and hard drive supplier Seagate to create a process that feeds recovered rare-earth magnets into new hard drives. Dell can collect HDDs in various forms/sizes via their global take-back streams where, in one year, about 1.4 million HDDs are retired.

Dell initially looked at previously tested recovery methods. After experiments, they found it better to separate the magnets, extract Neodymium Oxide and reform them into powerful Neodymium-Iron-Boron permanent magnets for new drives. As a result of the reforming process, recycled magnets can be used in numerous drive models at Dell and across the IT industry, irrespective of brand. These recycled magnets can even be used for application in other industries. This change is helping advance rare-earth oxide recovery and market access.

On Earth Day 2019, Dell, Teleplan and Seagate announced the successful introduction of the industry's first closed-loop process for recovering rare-earth magnets.³⁹ Using closed loop recycled rare earth material helps eliminate portions of environmental and social impacts of mining, while mitigating political and business risks associated with virgin material. These new drives began shipping in May 2019, displacing roughly 100kg of mined rare earth oxides, and creating 25,000 new hard drives for notebooks.





Figure 3 - Dell's circular material use infographic



Over one million tonnes of end of life electronics have been recycled to date in Canada.

Recycling

EPSC members comply with and strongly support provincially regulated recycling programs for responsible end-of-life management of their products and packaging across Canada. The regulatory landscape poses challenges with arbitrary collection targets and lack of harmonization for reporting. Despite challenges, over one million tonnes of end of life electronics have been recycled to date in Canada.⁴⁰

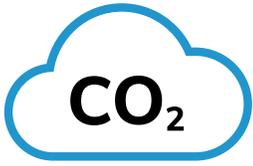
Consumers are essential to the success of recycling programs. Consumers ultimately decide how and when to dispose of their products once they reach the end of their useful life. Currently, 80% of Canadians have unused electronics at home⁴¹, representing a huge missed opportunity for reusing valuable materials.

TCL North America has doubled their recycling efforts year over year since 2014, funding the recycling of more than 23 million kilograms of electronics. As the number two television brand in North America, TCL has become one of the top contributors of electronic recycling and is working to increase the recyclability and amount of recycled content in their packaging.

ELECTRONICS RECYCLING DOWNSTREAM CHART, CANADA⁴²

Here is how collected electronics are broken down into useable commodities:

Recovered Materials	From Electronics	Amount Recovered (Tonnes)	Primary Processing	Location	Downstream Processing	Location	End-Use
Ferrous Metals	TVs, Desktop Computers, Laptops	36,571	Dismantled, separated and shredded	Canada	Smelting	Canada, USA	Sold globally as commodity
Aluminum	Hard drives, TV and Computer Monitors	2,636	Dismantled, separated and shredded	Canada	Smelting	Canada, USA	Sold globally as commodity
Mercury Lamps	Used as backlighting in LCDs, Monitors, TV screens, Scanners and Copiers	53	Cold Cathode Fluorescent Lamps (CCFLs) extracted from electronics	Canada	Retorted	Canada	Reclaimed elemental mercury
Plastic	TVs, Desktop Printers, Computer Monitors, Computer peripherals and screens, Scanners and Copiers	33,000 (= 15% of EEE plastic waste generated annually that is recovered) ⁴³	Dismantled, separated, then shredded or pelletized	Canada	Sorted according to resin type as well as presence or absence of flame retardants	Malaysia, India, Vietnam, Thailand, Taiwan	Sold globally as commodity
					Processed for energy recovery	USA	Energy recovery
Circuit Boards	From TVs, Desktop Computers, Laptops, Printers, Mobile Phones, etc.	9,167	Dismantled or shredded	Canada	Precious and base metal extraction (e.g. gold, silver, palladium, copper)	Canada, Belgium, Japan, Sweden, USA	Sold globally as commodity
Copper	Cables and Wires	1,761	Separated	Canada	Smelting	Canada, USA, Belgium, Japan	Sold globally as commodity
Leaded Glass	CRT, TVs, and Computer Monitors	19,721	Dismantled and separated	Canada	Smelted for reclaim of lead from the glass Glass to glass processing	Canada, USA, Brazil	Sold globally as commodity
Non-Leaded Glass	TVs, Computer Monitors	736	Dismantled and separated	Canada	Cleaned, and processed	Canada, USA	Sold to be used in glass products and construction materials (reflective highway paint)
Ink/Toner Cartridges	Printers	1,547	Cleaned and reconditioned 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
Embedded Batteries	Laptops, Tablets, Mobile Phones etc.	544	Separated from electronics	Canada	Smelting or chemical extraction of materials	Canada, USA	Sold back into battery manufacturing with some elements used as fertilizers



Microsoft's 100 top suppliers reported an average of \$530K invested in emissions reduction activities, reducing their collective footprint by 5.6 million metric tonnes of carbon dioxide equivalents, in 2019.⁴⁶

Global Supply Chain

Manufacturing involves a global network of thousands of suppliers who provide the parts that go into finished products. Ensuring responsible manufacturing practices within our industry's extended operations of global suppliers is critical to advancing sustainability and reducing environmental impact.

Through strong supplier contractual requirements, Supplier Codes of Conducts, sustainable procurement policies, and regular auditing and monitoring of supplier activities and performance, electronic product manufacturers are driving transparency, accountability, resource efficiency, and continuous improvement throughout their global supply chains.

Cisco has achieved 91% of its reduction goal to avoid 1 million metric tonnes cumulative of GHG emissions in its supply chain from FY12 to FY20.⁴⁴

Apple doubled the number of suppliers that have committed to run their Apple production on 100% clean energy, bringing the total number to 44, allowing it to exceed its goal of bringing 4 gigawatts of renewable energy into its supply chain by 2020, with over an additional gigawatt projected within that timeframe.⁴⁵



City of Vancouver's procurement policy embeds sustainability and ethical considerations into its supplier vetting process.

In the interests of working to mitigate climate change, EPSC encourages sustainable public procurement policies for all government purchases across all provinces and territories.

While the federal government has published its initiatives related to green procurement⁴⁷, only a few provinces have done the same (Nova Scotia, Quebec, British Columbia). The City of Vancouver's procurement policy embeds sustainability and ethical considerations into its process, where the proponent must meet minimum requirements related to ethical, social, and environmental standards, as set out in its Supplier Code of Conduct, and complete an Assessment of Vendor Sustainability Leadership Questionnaire to identify where suppliers are demonstrating sustainability leadership in their own operations and innovation.⁴⁸

Consumer Electronics Manufacturing Supply Chain

Consumer electronics have some of the most complex supply chains in the world, crossing international borders and involving thousands of suppliers of parts and materials that go into finished products.

Countries have specialized in sourcing components for each stage of the process of manufacturing and assembling of consumer electronic products. Manufacturers rely on a select number of suppliers who are capable of producing specialized technological components – such as silicone chips used in smartphones, servers and modems. A global interdependence exists as components are passed on from one firm to another across different countries.

If something changes in one country, there are ripple effects across the entire supply chain that impact the flow of parts and finished goods. These issues include changes in government policies such as tariffs or trade barriers, natural disasters such as the current pandemic, and availability of technically skilled labour - all representing risks to the consumer electronic manufacturing supply chains.

CONSUMER ELECTRONICS GLOBAL MANUFACTURING SUPPLY CHAIN

 **USA:**
HQ: Apple, Cisco, Dell, HP, Microsoft, IBM, CIARA, HPE, Lexmark, Oracle
Produces half the world's baseband processors – i.e. modem chips that manage wireless connections (Qualcomm); 'server-class' chips (Intel) based on UK design; software - Android (used in 75% of all smartphones).

 **UK:**
Design of 'server-class' chips used in almost all of world's data centres (produced by Intel).

 **Netherlands:**
HQ: Phillips
ASML – world's only maker of lithography equipment using extreme ultraviolet light to make transistors for advanced chips.

 **China:**
HQ: Lenovo, TCL
Manufacturing hub due to large working population.
China is the world's largest producer of rare earth elements (REEs), accounting for nearly 90% of global annual production, estimated at 135,000 tonnes. The remaining 10% is shared among four other countries: **Australia, Myanmar, Russia** and **Malaysia**. China remains virtually the only producer of the valued heavy REEs.⁴⁹

[mining-materials/facts/rare-earth-elements/20522](#)



Taiwan:

HQ: Asus, BenQ

Home of foundries that turn silicon into microprocessors (largest is Taiwan Semiconductor Manufacturing Company, one of only three firms capable of producing cutting-edge microprocessors, the other two being Intel and Samsung).



Vietnam

Most of Samsung's smartphone production is located in Vietnam, where its factories produce almost a third of the firm's total global output.⁵⁰



South Korea:

HQ: Samsung, LGE

Memory chips from Samsung for smartphones



Japan:

HQ: Canon, Panasonic, Sony, Brother, Epson, Fujitsu, Ricoh

Copper foils for printed circuit boards; silicon wafers to make chips; resin to package these parts; bulk of chemicals and other materials used to make microchips.

Chemicals sourced in Japan:

- Photoresists – used to transfer circuit patterns onto semiconductor wafers, essential to chipmaking
- Hydrogen fluoride – used as an etching gas in the chipmaking process, used also for display production
- Fluorinated polyimides – used in smartphone displays (e.g. foldable panels) - case example⁵¹



“Climate change requires individuals, industry, and governments to act collectively.”
2018 United Nations Intergovernmental Panel on Climate.

Interdependence days

Selected tech companies

Company	Country	Market	Market share 2018 or latest, %
Samsung Electronics	South Korea	Smartphone displays	58
Foxconn	Taiwan	Electronics assembly	No data
Google	US	Mobile operating system	75
Intel	US	Server chips	99
TSMC	Taiwan	Contract chipmaking	48
Qualcomm	US	Modern chips	40
ASML	Netherlands	Lithography equipment	90+
Arm Holdings	Britain	Smartphone-chip design	99+

Sources: Company reports; The Information Network; press reports

The Economist

Figure 4 - Consumer electronics manufacturing supply chain interdependence ⁵²

Designing Products to use less Energy and Carbon

Reducing greenhouse gas emissions is a priority for electronic product manufacturers, who are lessening their carbon footprint through innovative products, design changes, internal carbon pricing policies, integrating climate risks and opportunities into corporate strategies and governance frameworks, and partnering with their supply chains.

Microsoft launched the aggressive program to cut its carbon emissions by more than half by 2030, both for its direct emissions and for its entire supply and value chain, to be funded in part by expanding its internal carbon fee. Beginning next year, Microsoft will also make carbon reduction an explicit aspect of their procurement processes for its supply chain. ⁵³



Microsoft is launching an initiative to use Microsoft technology to help their suppliers and customers reduce their own carbon footprints, plus a new \$1 billion climate innovation fund to accelerate the global development of carbon reduction, capture and removal technologies.

Microsoft’s pathway to carbon negative by 2030

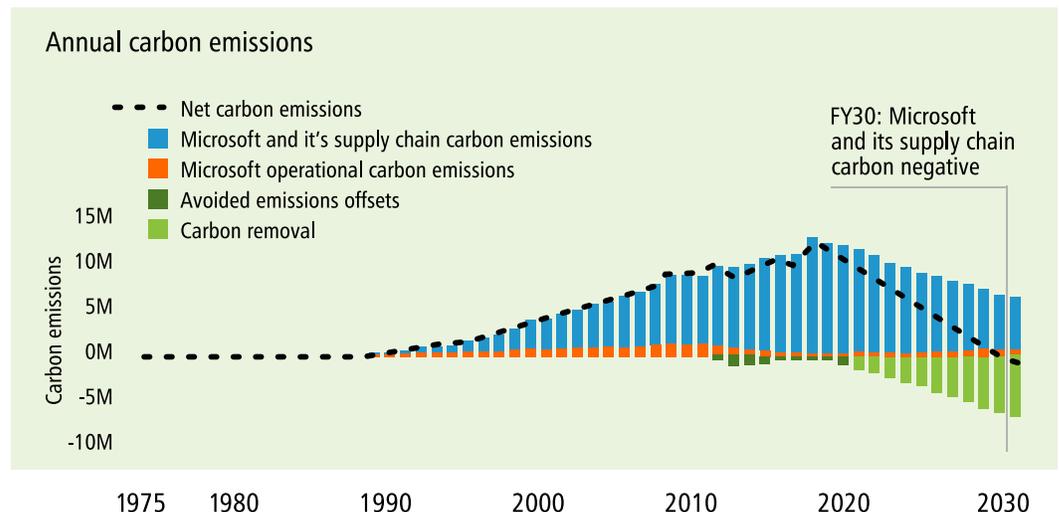


Figure 5 - Microsoft reducing carbon emissions

DESIGN for ENVIRONMENT 2020 REPORT



The not-for-profit International Electronics Manufacturing Initiative (iNEMI) roadmaps the future technology requirements of the global electronics industry, identifies and prioritizes technology and infrastructure gaps, and helps eliminate those gaps through timely, high-impact deployment projects.

Lenovo invented a low temperature solder (LTS), which uses tin as an alternative during high heat manufacturing, reducing energy and emitting less carbon. At the end of 2018, Lenovo had 10 surface mount technology lines using the process, resulting in an estimated annual reduction of 2,466 metric tonnes of carbon emissions. Lenovo is working with the International Electronics Manufacturing Initiative (iNEMI) to deploy this technology more widely in the industry.⁵⁴

TCL's Liquid Crystal TV Backlighting Control System detects the brightness of natural light surrounding the screen, activating a backlight algorithm and automatically adjusting the backlight intensity. The result is the significant improvement of image quality while achieving a 40% reduction in energy consumption.⁵⁵

Apple has helped to develop the world's first aluminum produced through a carbon-free smelting process. In a joint venture with aluminum manufacturers Alcoa Corporation and Rio Tinto Aluminum, Apple will commercialize patented technology that eliminates direct greenhouse gas emissions from the traditional smelting process, a key step in aluminum production, representing a revolutionary advancement in the manufacturing of a widely used metal. Apple has partnered with both aluminum companies and the governments of Canada and Quebec to collectively invest a combined \$144 million in future research and development. In the last year, Apple reduced emissions from aluminum in its products by 45%.⁵⁶



Figure 6 - The world's first aluminum produced through a carbon-free smelting process⁵⁷

The carbon footprint of aluminum enclosures of MacBook computers has been steadily decreasing since 2015—for some products, it's over six times less. This has been accomplished by sourcing aluminum from hydro-powered smelters, improving the material efficiency of manufacturing processes, and increasing recycled content in products. And by using 100 percent recycled aluminum for the enclosure of the new MacBook Air with Retina display, the product's carbon footprint was cut in half.

Panasonic's factories in Japan and Belgium have become the world's first zero-CO2 emission factories through the installation of renewable energy power generation systems, procurement of renewable electricity, and using carbon credits to offset CO2 emissions. These factories are expected to reduce carbon emissions by a combined total of approximately 5,000 tonnes per year.⁵⁸



Panasonic's factories in Japan and Belgium have become the world's first zero-CO2 emission factories, which are expected to reduce their carbon emissions by a combined total of approximately 5,000 tons per year.



In 2018, IBM implemented approximately 1,900 energy conservation projects, which avoided the consumption of 151,000 MWh of energy and an associated 53,000 metric tonnes of carbon emissions.⁶⁰

IBM announced they support putting a price on carbon and have endorsed the plan outlined by the Climate Leadership Council that would put a tax on carbon dioxide emissions. IBM has reduced the carbon dioxide emissions associated with its consumption of energy by 32% since 2005, and conserves energy equal to at least 3% of its annual consumption, preferring to reduce consumption rather than to purchase offsets.⁵⁹

Sony addresses climate change throughout its business activities and product lifecycles by improving energy efficiency. They are working to reduce the power consumption of AC-powered devices by 30% by 2020 and have so far achieved a decrease of 50.8% in the 2019 fiscal year.⁶¹

Cisco increased its total on-site solar PV capacity from 200 kW to 3 MW from 2012 through 2018. Collectively, these systems produce an average 3.4 million kWh of electricity, avoiding 1,400 metric tonnes of CO2 emissions each year over the projected 25-year life of the systems.⁶²

Dell has reduced the energy intensity of its product portfolio by 64 percent from a 2012 baseline and projections indicate they should achieve at least a 73 percent reduction by the end of 2021. Dell reduced the energy intensity of its server portfolio by almost 78 percent from a 2012 baseline. 2019 was the first full year of sales for the more energy efficient 14th generation of Dell PowerEdge™ servers, which was a key driver of energy intensity reductions.⁶³



PowerEdge

Dell has reduced the energy intensity of its product portfolio by 64 percent from a 2012 baseline with a reduction of at least 73 percent projected by the end of 2021.

Portfolio Energy Intensity - Lifetime MWh/Delivered Capability

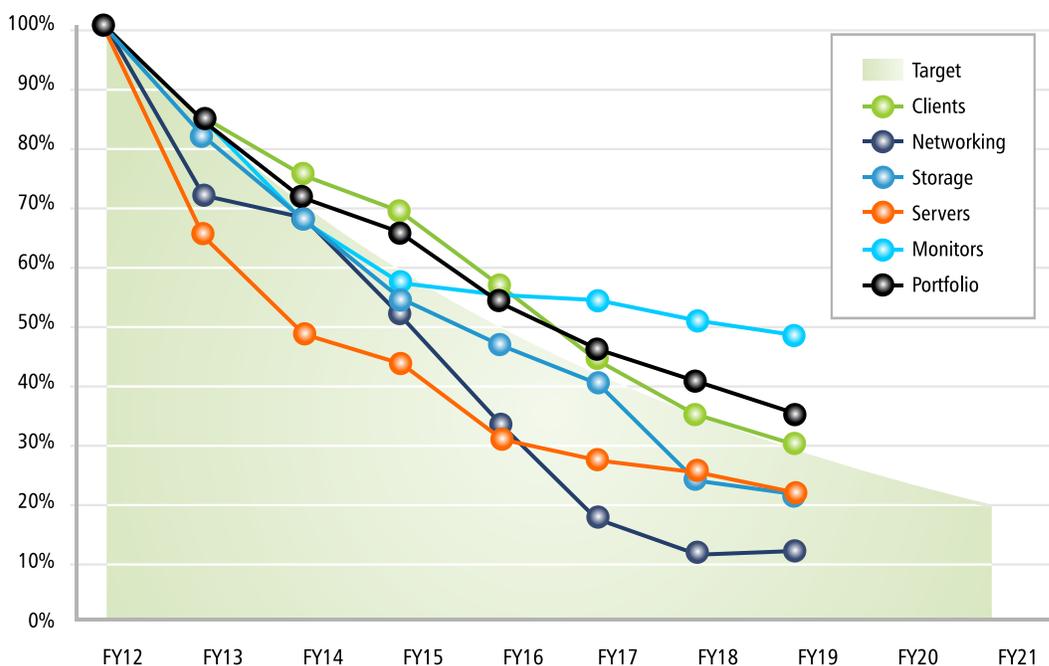


Figure 7 - History of Dell's product portfolio energy metric (percent of FY12 baseline)



A study conducted by Microsoft found that the cloud is up to 93% more energy-efficient and can result in 98% lower carbon emissions than traditional enterprise data centers.

Cloud Computing

Historically, organizations have purchased, operated, and maintained, their own IT systems in-house, which meant acquiring and installing physical hardware such as servers and network equipment that needed to be secured in a climate controlled physical space.

With the increasing adoption of digital transformation strategies, organizations have been moving away from having to rely on physical data centres and traditional IT equipment, instead embracing cloud computing, in which infrastructure and software are services that are accessed online, providing the same services as before, but without having to buy and maintain physical assets as these IT resources are managed off-site.⁶⁴

Cloud computing essentially means getting out of the data centre business, which in turn means reducing hardware requirements and power consumption, resulting in a positive environmental impact. Data centres consume about 1% percent of the total electricity used in Canada every year. About half of the energy consumed in a data centre is used by computing servers with another 40% going to cooling the servers.⁶⁵

A study conducted by Microsoft found that the cloud is up to 93% more energy-efficient and can result in 98% lower carbon emissions than traditional enterprise data centers.⁶⁶ Those savings were attributed to four key factors⁶⁷:



- 1. IT operational efficiency** – Commercial cloud services can operate with greater efficiency than smaller, on-premises deployments thanks to large-scale dynamic provisioning and multitenancy, which allow for more efficient use of IT resources.
- 2. IT equipment efficiency** – Microsoft tailors its large-scale hardware components to find the most efficient ways to power the specific needs of its services.
- 3. Data center infrastructure efficiency** – Advanced technologies significantly reduce electricity requirements for lighting, cooling and power conditioning.
- 4. Renewable electricity** – Consolidated electricity demand creates the potential for large-scale purchases of green power that would not be otherwise viable.

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Electronics Product
Stewardship Canada



About EPSC

EPSC represents 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:

Board Members

- Apple Canada Inc.
- Canon Canada Inc.
- Cisco Systems Canada Inc.
- Dell Canada Inc.
- HP Canada Co.
- IBM Canada Ltd.
- Lenovo Canada Inc.
- Microsoft Corporation
- Panasonic Canada Inc.
- Samsung Electronics Canada Inc.
- Sony North America
- TCL North America

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- Asus
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- Brother International Corp.
- CIARA Technologies
- Epson of America Inc.
- Fujitsu Canada Inc.
- Hewlett Packard Enterprise
- LG Electronics Canada, Inc.
- Lexmark Canada Inc.
- Northern Micro Inc.
- Oracle America Inc.
- Philips-MMD
- Ricoh Canada Inc.

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