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Promoting Sustainable Materials Management Through Extended Producer Responsibility: Canadian Waste Electrical and Electronic Equipment (WEEE) Case Study

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I. Introduction

Over the past 20 years, Canada has recognized product stewardship as an important policy tool for shifting the responsibility, either physical and/or financial, for the management of end-of-life products towards producers and consumers and away from municipalities and general taxpayers.

Extended producer responsibility (EPR) programs have emerged as an effective stewardship approach to promote and ensure the proper end-of-life management of a broad and growing range of post-consumer products. In 2009, through the Canadian Council of Ministers of the Environment, Canada officially recognized EPR and provided support by preparing the Canada-wide Action Plan (CAP) for EPR, listing the following post-consumer products for management: packaging, printed materials, mercury containing lamps, other mercury containing products, household hazardous and special wastes, automotive and waste electrical and electronic equipment (WEEE). In addition, further commitments have been made to address ozone-depleting substances, construction materials, demolition materials, furniture, textiles and carpets. Provincial waste management regulations also commonly mandate recycling programs for the diversion of paint, pesticide containers, used oil, used tires and pharmaceuticals and sharps.

The United Nations Environment Program (UNEP) reports that WEEE accounts for 5% of all municipal solid waste. In Canada's largest province, Ontario, WEEE is estimated to be less than 1% of the waste stream. Electronic products, for the most part, are not manufactured but rather imported in Canada and recognized as the fastest growing components of the municipal solid waste stream in North America.

In 2004, Alberta became the first Canadian province to pass legislation requiring the environmentally sound management of WEEE. Nearly all provinces have since followed suit to develop and implement regulations founded on the principles and practices of EPR. Since 2004, Canada's recycling programs have diverted over 533,311 tonnes of WEEE from landfills, 125,423 tonnes in 2012 alone as the programs have grown significantly in recent years from expanding to cover more products in 11 key product categories. By 2013, with over 97% of the national population covered by WEEE EPR regulations, most Canadians had access to facilities that would take back a wide selection of WEEE and ensure that their materials were responsibly recovered.

The case study that follows is intended to provide a comprehensive overview of Canada's experience with EPR regulations and programs for managing electronic waste. Included in this overview is a discussion of how programs are designed, governed, and financed, and who is ultimately responsible for program operation. The case study concludes with some lessons and notes about future developments in Canada.

II. Policy and Legal Aspects

In Canada, the responsibility for managing and reducing waste is shared among federal, provincial, territorial, and municipal governments. EPR programs are regulated under the jurisdiction of provincial and territorial authorities, each using varying approaches to reach

common EPR objectives. A national picture of EPR in Canada, therefore, accounts for these provincial variations.

The Canadian Council of Ministers of the Environment (CCME) is an intergovernmental forum for collective action on environmental issues of national and international concern¹. The CCME is made up of the 14 environmental ministers from federal, provincial, and territorial governments. These ministers convene at least once a year to discuss and develop national strategies, norms, and guidelines that each environment ministry across Canada can use to address a variety of environmental issues.

In 2009, the CCME developed the Canada-wide Action Plan (CAP) for Extended Producer Responsibility (EPR). Through the CAP, the CCME and its member jurisdictions committed to working towards the development and implementation of EPR programs to provide guidance on how to strengthen the use of EPR and promote the harmonization and consistency of programs across the country. The goal of the CAP is to increase diversion and recycling of municipal solid waste through the harmonization of provincial EPR programs. Phase 1 of the CAP calls for a number of commitments from provinces and territories, including the implementation of EPR programs for electrical and electronic products by 2015. The jurisdiction for EPR programs rests with the Provinces.

In addition, the CCME developed a tool to foster a consistent national approach in the implementation of programs. The twelve Canada-wide principles for electronics stewardship were approved in order to assist and support jurisdictions in the development of programs for managing WEEE. These principles include:

1. Producer responsibility for management of materials;
2. Costs of management not borne by municipal taxpayers;
3. Minimization of health and environmental impacts throughout the product life-cycle, from design to end-of-life management;
4. Management of materials consistent with the 4Rs (reduction, reuse, recycling and recovery) waste management hierarchy;
5. Free consumer access to collection;
6. Ensure that all stakeholders are aware of their roles and responsibilities under the program;
7. Consistent and equitable program design and implementation, particularly between those in small, rural, and remote communities and large urban centers;
8. Strive for consistency in WEEE products collected;
9. Inclusion of residential, commercial, historic and orphan products;
10. Performance targets and transparency in financial management;
11. Maximization of local economic and social benefits; and,
12. Export only to facilities with a documented commitment to environmental, health, and safety best practices.

Today, nine of ten Canadian provinces have WEEE regulations and programs in place to divert and recover a range of electrical and electronic products, founded on the principles and

¹ Canadian Council of Ministers of the Environment, "About CCME," <http://www.ccme.ca/index.html>, accessed 15 December 2013.

practices of extended producer responsibility (EPR). Canada’s Northern territories – Northwest Territories, Nunavut, and Yukon – do not have extended producer responsibility programs in place, as of yet. Considering that these territories are home to approximately 100,000 people spread across almost 4,000,000 km², the Canadian Council of Ministers of the Environment (CCME) recognized in its Action Plan that EPR may not be appropriate or feasible in these remote regions given the unique circumstances and high transportation costs. A combination of other measures is being examined in order to achieve the desired results². Figure 1 shows the sequence of WEEE program implementation across Canada.

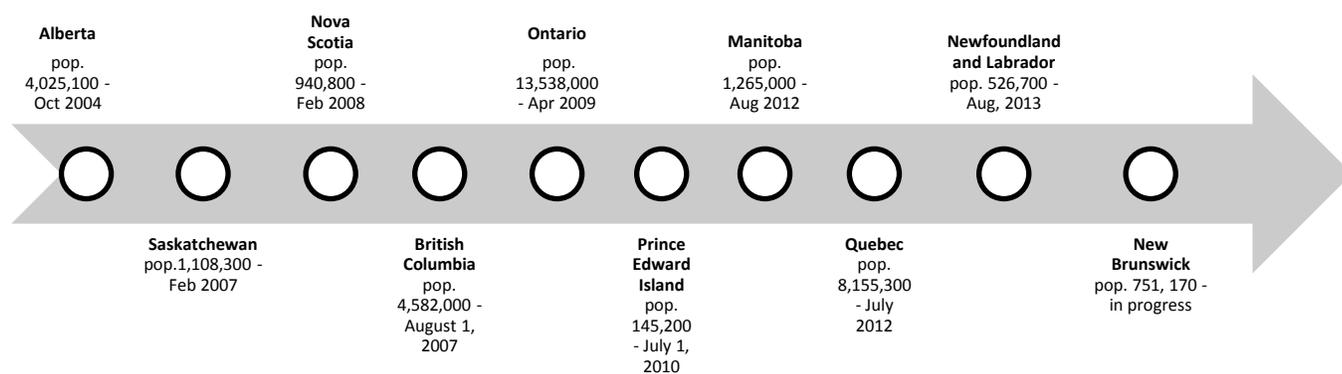


Figure 1: Timeline showing the introduction of WEEE management programs across Canada.

III. Governance of the System

a. Roles and Responsibilities

The management of WEEE through the implementation of EPR programs in Canada involves a number of key players including producers, producer responsibility organizations, retailers, municipal and provincial governments, consumers, collectors, and processors. A summary of their associated roles and responsibilities, as well as each of their legal obligations are provided in Table 1.

Table 1: WEEE management in Canada: Summary of key stakeholders, roles and responsibilities.

Stakeholder	Roles, Responsibilities and Legal Obligations
Producer (manufacturer and/or first importer)	<ul style="list-style-type: none"> Integrate design for environment (DfE) principles into the product design process so as to minimize environmental and human health impacts; Establish a not-for-profit organization (industry collective) to act as the stewardship agent representing producers <i>or</i> develop and submit an industry stewardship plan (ISP) to operate their own program;

² Canadian Council of Ministers of the Environment, “Canada-wide Action Plan for Extended Producer Responsibility,”

	<ul style="list-style-type: none"> • If joining an industry collective, register with the Producer Responsibility Organization (PRO); • Report designated product sales and remit EHF to PRO or government oversight agency on a monthly basis. If producers do not join a collective, they must operate and fund an individual waste stewardship program for the products they sell; • Track key performance metrics and report out on an annual basis.
Producer Responsibility Organization (PRO)	<ul style="list-style-type: none"> • Manage and operate an electronic waste stewardship program on behalf of obligated stewards of designated products; • Collect fees from the companies it represents to finance the program; • Register and contract with authorized service providers; • May act as collectors and/or establish depots for collection; • Communicate with and educate the public on WEEE diversion; • Track key performance metrics and publicly report out on an annual basis.
Retailer/First importer	<ul style="list-style-type: none"> • Charge and collect EHF (if applicable) from consumers at the point of purchase; • File and submit monthly, quarterly or annual reports (depending on the size of the annual remittance) for quantities of electrical and electronic equipment (EEE) supplied onto the marketplace and remit appropriate EHF to the PRO; • Where return-to-retail programs are in place, take back used product free-of-charge from consumers; • Provide consumers with information on the EPR program, including what products are included, why they are being charged an EHF, and what the EHF is used for.
Municipality	<ul style="list-style-type: none"> • May enter into contract with a PRO and participate in the collection of designated WEEE as a service provider; • Control public access to municipal disposal sites and recycling and/or refurbishing facilities; • Communicate with and educate the public on WEEE diversion options; • Support the program via green procurement policies; • Develop and implement secondary policies to support EPR programs (e.g. landfill bans).
Provincial Government	<ul style="list-style-type: none"> • Develop, monitor, and administer regulations for the management of WEEE; • Set mandatory collection, reuse, and recycling targets for those materials designated under the EPR program; • Review and approve industry stewardship plans; • Establish service standards for program accessibility and recycling standards for downstream processors and recyclers; • Monitor and oversee program operations, including performance against mandated targets; • Provide the necessary compliance and enforcement measures.

Consumer	<ul style="list-style-type: none"> • Pay the EHF on designated products at time of purchase (if applicable); • Participate in collection program by using the available reuse and recycling options (e.g. returning designated WEEE to a designated retailer, collection event, or depot).
Collector	<ul style="list-style-type: none"> • Register with and obtain approval from the PRO to accept designated WEEE; • Collect WEEE in such a way that meets or exceeds all environmental, health, safety, export and other regulations and standards; • Deliver WEEE to a registered consolidation point or processor.
Processors	<ul style="list-style-type: none"> • Process/Recycle designated WEEE according to PRO standard; • Ensure that WEEE undergoes environmentally sound management, which includes meeting applicable laws and standards (Canadian and international) for health and safety, and environmental protection and PRO processing standards; • Ship processed WEEE to recycling end-markets.
Reusers or Refurbishers	<ul style="list-style-type: none"> • Provide functioning WEEE to users without repairing or modifying the hardware; • Replace, repair, or redistribute parts of equipment; • Send any electronic waste for reprocessing to a processor.

b. Objectives and Targets

Key Definitions

Extended Producer Responsibility: Adopting a similar definition to the Organization for Economic Cooperation and Development (OECD), the Canadian Council of Ministers of the Environment (CCME) defines Extended Producer Responsibility (EPR) as “*an environmental policy approach in which a producer’s responsibility for a product is extended to the post-consumer stage of its life cycle*”³.

Producer: While each province defines “producer” a little differently, the term generally refers to the product manufacturer, distributor, brand-owner, first importer or first seller who places the designated product on the market for sale. A producer could also be a retailer, franchisee, or wholesaler who sells a product directly to the consumer.

Recovery vs. collection rate: One of the principal elements of performance measurements deals with the calculation of post-consumer products diverted from the waste stream. Two terms are generally used in regulations: *recovery rate* and *collection rate*. Despite the difference in terms and the variations of definitions used across provinces, the terms generally refer to the same thing.

³ Canadian Council of Ministers of the Environment (CCME), “Canada-wide Action Plan for Extended Producer Responsibility (EPR),” http://www.ccme.ca/assets/pdf/epr_cap.pdf, 29 October 2009.

Scope

Although provincial programs have a few things in common (they all use a combination of measures to divert WEEE from landfill, rely on fees to finance program costs, and limit coverage of items designated as WEEE in the regulations), there are also some notable differences. Some of the main differences concern targets, products covered, program plan requirements, and consumer collection infrastructure.

When it comes to which items are covered by WEEE EPR regulations, each province is somewhat different. In order to allow producers sufficient time to adapt to the regulations, most provinces have rolled out their WEEE programs gradually, with varying phased-in implementation dates for specific categories of products. For example the province of Nova Scotia: Phase 1 (2008) of the program included laptop/desktop computers, printers, monitors and televisions. Computer scanners, telephones, fax machines, cell phones, and audio and video playback recording systems only became subject to the regulations one year later (Phase 2). Another example is British Columbia, which launched its program in five phases and ultimately covers a much wider range of products.

Targets

Most stewardship plans specify minimum targets for the collection and recycling of WEEE. In British Columbia, for instance, the Recycling Regulation requests that stewardship plans demonstrate they are capable of achieving a 75% recovery rate (the amount of product recovered divided by the amount of product generated) or another recovery rate established by the director. However, depending on the nature of the product, meaningful alternative performance measures with related multi-year targets may also be considered. Similar targets are set in the province of Quebec. By 2015, Quebec aims to achieve the following recovery targets: 40% for desktops and laptops (with this percentage to increase to 65% in 2020), 25% for cellular phones (with this percentage to increase to 65% in 2023), and 20% for single-use batteries (with this percentage to increase to 65% in 2024). For the most part, provincial regulations are silent on recovery for energy since there are few such facilities in Canada.

Ontario's WEEE Program Plan includes recycling targets as well. Specifically, by 2014, the province aims to achieve recovery rates (expressed as percentages of the products available for recycling) of 87% for desktop and portable computers and 47% for other Phase 1 and 2 products (e.g. cell-phone products, non-cellular phones and answering machines, etc.).

Quebec has introduced additional measures to support its provincial collection goals and targets. As part of its EPR regulations, financial penalties for producers who fail to meet collection targets are to become effective in 2018, five years after program commencement. These penalties also act as an incentive for stewards to join a collective PRO rather than attempting more administratively complex individual programs.

Table 2: Financial penalties on producers for missing collection targets under Quebec’s electronics recycling program (to be applied in 2018) (in Canadian dollars)

Category	Penalty
Desktop computers	\$10.00/unit
Portable computers	\$2.00/unit or equivalent weight
Display devices ≤ 29 inches	\$15.00/unit
Display devices ≥29 inches	\$15.00/unit
Computer printers	\$5.00/unit or equivalent weight
Desktop computer scanners	\$5.00/unit or equivalent weight
Personal/portable A/V playback/recording system	\$1.00/unit or equivalent weight
Home theatre in a box (HTIB) systems	\$4.00/unit or equivalent weight
Non cellular phones and answering machines	\$0.50/unit or equivalent weight

Compliance

Electronics producers in Canada generally comply with provincial EPR obligations by joining a producer responsibility organization (PRO) (also called an industry funding organization (IFO)). With the exception of Alberta, the Canada-wide Electronic Products Recycling Association (EPRA) is the PRO responsible for representing obligated stewards selling electronic products covered by EPR regulations in a given province. On behalf of obligated stewards, EPRA is responsible for developing, implementing, promoting, financing, and operating province-wide programs for the safe and effective management of WEEE.

While Quebec is the only province to regulate penalties for producers who fail to meet collection targets specifically, most provincial regulations include general sanctions for other non-compliance aspects. For example, Waste Diversion Ontario has the power to remove the mandate from an underperforming producer responsibility organization.

c. Financing Schemes

There are significant costs associated with managing Canada’s WEEE programs. In general, program costs can be grouped in three broad categories:

- Collection: requires a series of procedures to ensure that the safety and health of all staff handling WEEE is maintained;
- Operations: consolidation, transportation and final processing of WEEE;

- Program administration: public communication and education, research and development (R&D), as well as contingency planning.

In 2012, the costs to operate Canada's WEEE collection programs ranged from \$1,105 per tonne in Ontario to \$1,822 per tonne in Saskatchewan (this includes the overall costs of delivering the programs, including collection, consolidation, transportation, audits, processing, administration, communications, R&D, and management). While EPR programs are generally established with a financial sustainability objective in mind, not all Canadian programs have achieved this objective at this time. Table 10 in Annex B shows the full breakdown of program revenues and expenses by program for the year ended December 31, 2012 (in Canadian dollars).

Environmental Handling Fees

A key component of the funding model adopted for the implementation of EPR in Canada includes the use of environmental handling fees (EHFs). These fees, which are paid by obligated stewards and passed on to customers at the point of purchase, are determined on a per unit basis and can vary between provinces depending on the costs required to operate the program, such as the costs associated with collection, transportation, and processing.

Since EHFs are intended to reflect the cost to manage a particular category of designated EEE products entering the waste stream, they are not uniform across product categories and vary depending on a myriad of factors:

- The amount of old products still in the market that never paid an EHF;
- Orphan products that no longer have a brand owner in the market;
- The size, weight, and quantity of WEEE diverted from landfills (e.g. the EHF on a cellular phone is much lower compared to an office photocopier);
- The makeup of the product of recycled components (i.e. a product with few recyclable components, or that is more difficult to disassemble, will have a higher EHF than a product with many recyclable components or that is easy to take apart and repair);
- The total product weight per category;
- The costs of program administration, collection, and recycling;
- Product sales and forecasts.

According to August 2013 data, EHFs levied on WEEE ranged from \$3.00 for desktop computers in Ontario to \$15.00 in Saskatchewan and Manitoba. EHFs levied on computer printers ranged from \$4.80 in Alberta to \$10.35 in Ontario. To ensure that EHFs are set at the appropriate level, they are reviewed on a regular basis by EPRA.

Fee Setting Methodology and Fee Visibility

The fees that stewards must pay to the producer responsibility organization (PRO) for managing their WEEE are reviewed and adjusted as required. In Annex C, the fee-setting methodology approved by two Canadian provinces, Ontario and British Columbia, to calculate steward fees under their respective WEEE stewardship plans, are described. Also important to note is that EHFs are to be charged only once in the supply chain, although they may be passed down

through the product supply chain to the final consumer. Inflation of the fees through the supply chain is a significant concern, if they are internalized.

A significant issue for setting fees for products such as electronics has been the fast pace of technological change. Light-weighting and evolution of multifunctional devices pose particular challenges to regulators and PROs to ensure adequate revenues are generated to implement the programs (See section on Challenges and Lessons Learned).

In most provinces, manufacturers and retailers have a choice: they can incorporate EHF into the price of the product, or they can display them as a separate charge on the consumer's sales receipt. In Quebec, the Consumer Protection Act requires that the advertised price of the product must include the EHF, therefore making the advertised price the final price. However, a separate line item identifying the EHF on the sales receipt is the norm in Quebec. More so for WEEE than any other product category, fee visibility at the point of sale has been debated. Producers have been advocates of being able to determine how costs should be passed through to consumers and how they should be identified at point of sale.

Applicable Taxes

As with the sale of most goods and services in Canada, consumers must pay a tax on the purchase of electrical and electronic equipment. In addition to paying tax on the product itself, the EHF is subject to sales tax as well, as it is considered to be part of the price of designated products. If the EHF is built-in to the price of the product, then it will also be taxed as part of the total product price. It is important to note, however, that while the applicable tax is remitted to government, no part of the EHF itself is remitted to government.

The situation is different in Ontario, however, because the PROs are appointed by the government agency, Waste Diversion Ontario, which is not allowed an input tax credit for HST. This results in significantly higher costs in Ontario compared to other Provinces.

d. Oversight and Reporting Obligations

Oversight

In Canada, most provincial environment ministries lead the establishment of WEEE EPR regulations, provide program overights, and ensure compliance. In some provinces, oversight and management of programs has been delegated to organizations mandated to do so. For example, in Ontario, the organization with oversight authority of the EPR program is Waste Diversion Ontario (WDO) – a non-crown corporation created through the *Waste Diversion Act* (2002). WDO is responsible for monitoring these programs to ensure they meet diversion targets and are financed by the producers of the materials being diverted. WDO reports directly to the Ontario Ministry of the Environment and is entirely funded by industry.

Recyc-Québec, a crown corporation, has a similar oversight role for product stewardship programs in the province of Quebec. Reporting to the environmental authority (the Minister of Sustainable Development, the Environment, and Parks) Recyc-Québec is administered by a board of directors composed of 11 members appointed by the government.

Transparency

Program transparency is achieved in several ways:

- Consultation: most, if not all, provincial WEEE EPR regulations include requirements for consultation with interested and affected stakeholders.
- Regular reporting: all regulated WEEE programs in Canada require a report on the program results on an annual basis by submitting a report to the province's ministry of environment and/or oversight authority. Most regulations also stipulate that these reports must be made easily and publicly accessible, usually by posting a copy of it on the PRO's website and that of the oversight agency. Additional information is provided in the following section under "reporting obligations".
- Third-party audits: all programs have requirements to verify the accuracy of information submitted. This is achieved through financial audits and in some cases audits or program performance. Verification of downstream processors is also required but not always made public for contractual reasons.

Reporting Obligations

Provincial WEEE legislation in Canada typically requires program administrators to submit an annual report to the provincial government or environment agency on how the program is performing. For the most part, all programs require producers (or the stewardship organizations acting on their behalf) to report on the following:

- total WEEE collected and processed by material category (reported in tonnes, units, kilograms/capita, percentage of material collected, and percentage of material available for collection);
- total collection, transportation, consolidation, and processing costs per tonne by material category;
- the number of approved collection sites and events compared to accessibility targets;
- total volume recycled compared to recycling targets;
- total volume disposed;
- design for environment (DfE) initiatives;
- research and development (R&D) strategies;
- description of efforts undertaken to promote and communicate options for reuse and recycling;
- percentage of population with access to the program.

Some provinces, like British Columbia, have approved alternative performance measures such as mass balance reporting in order to track the flow of materials through the entire recycling chain.

Auditing

Financial statements audited by an independent third-party are required in most provinces. In addition, British Columbia also requires third-party non-financial audits of the program which gather information on: performance metrics; the location of collection sites and any changes since the last report; a description of how the product was managed according to the pollution

prevention hierarchy; the total amount of the producer’s product sold and recovered; and the producer’s recovery rate.⁴

In addition, all provincial programs under EPRA processor guidelines require third-party audits of downstream processors as set out in the EPRA compliance/audit procedures. Auditing of primary and downstream processors ensures compliance with environmental standards and regulations.

IV. Program Performance

a. Consumer Access

Accessibility of recycling programs to households and businesses across the country is important to measure program performance. This information is valuable since varying access between provinces may be responsible for the differences in provincial collection rates. Canadian experience with recycling systems have shown that the most effective way to significantly increase diversion is through a program that is convenient and easily accessible for everyone. In Canada, the population densities and varying city sizes, as well as distances to markets and key infrastructure, influences the collection approaches that have emerged in each of the provinces.

The Electronics Product Recycling Association (EPRA) measures access using two indicators: (1) the percentage of population within a specific driving distance of a collection depot; and (2) the number of collection sites. Table 3 shows the level of program accessibility by province.

Table 3: Access to WEEE recycling by province (2012)

Province	Accessibility Indicator	# of Collection Sites
British Columbia ⁵	97% of the population lives within 45 minutes (rural) or 30 minutes (urban) of a collection depot	142
Alberta ⁶	N/A	336
Saskatchewan ⁷	94% of the population lives within 50 km (rural) or 30 minutes (urban) of a collection depot	72
Manitoba ⁸	N/A	>30

⁴ Ministry of Environment, “Third Party Assurance Requirements for Non-Financial Information in Annual Reports,” *Government of British Columbia*, http://www.env.gov.bc.ca/epd/recycling/guide/pdf/third_party_assurance_requirements_implementation_schedule_2012.pdf, 31 July 2012.

⁵ Electronic Products Recycling Association, “Annual Report 2012,” <http://eprassociation.ca/ar/en/2012/EPRA2012%20-%20Annual%20Report.pdf>, 2012.

⁶ Alberta Recycling Management Authority, “The Promise of Environmental Stewardship: 2012/13 Annual Report to the 2012-2015 Business Plan,” <http://www.albertarecycling.ca/docs/annual-reports/2012-2013-alberta-recycling-annual-report--the-promise-of-responsible-environmental-stewardship.pdf?sfvrsn=0>, 2013.

⁷ SWEEP, “Annual Report 2012-2013,” http://www.recyclemyelectronics.ca/sk/wp-content/uploads/2013/08/SWEEP_AnnualReport2012_WEB.pdf, 2013.

⁸ Electronic Products Recycling Association, “New Electronics Recycling Program Begins Today,” <http://recyclemyelectronics.ca/mb/wp-content/uploads/2012/08/Media-Release-August-1-2012.pdf>, 1 August 2012.

Ontario ⁹	85% and 77% of the population lives within 25 km and 10km of a collection depot, respectively	444
Québec ¹⁰	92% of the population has EPRA-Québec collection coverage	270
Nova Scotia ¹¹	97 % of the population lives within 30 km (rural) or 30 minutes (urban) of a collection depot	37
Prince Edward Island ¹²	99% of the population lives within 30 km (rural) or 30 minutes (urban) of a collection depot	6

b. Environmental Effectiveness

Waste Collection

Together, Canadian WEEE programs collected over 125,000 tonnes of end-of-life (EOL) electronics (i.e. display devices; desktop computers; portable computers; computer peripherals; printing, copying, and multi-function devices; telephones and telephone answering machines; image, audio, and video devices) in 2012^{13,14,15}. Table 4 shows the amount of material collected in selected provinces with a regulated recycling program, along with data for five other core performance indicators.

While it is possible to showcase collective results (Table 4), it is important to note that each province uses a different approach for determining program performance and reaches its targets by different means, which limits performance comparisons as well as national compilations. For example, the scope of products covered by programs is not the same across the provinces and, therefore, the comparison of programs is not an accurate reflection of individual program performance.

Table 4: Performance indicators for Canadian WEEE programs (2012)*

Indicator	British Columbia	Alberta	Saskatchewan	Ontario	Nova Scotia	Prince Edward Island
Population	4,582,000	4,025,100	1,108,300	13,538,000	940,800	145,200
Tonnes Collected	21,963	17,280	3,080	75,702	4,719	649

⁹ Ontario Electronic Stewardship, "2012 Annual Report," <http://www.ontarioelectronicstewardship.ca/sites/all/files/annualreport/2012/index.html>, 2012.

¹⁰ Electronic Products Recycling Association, "Annual Report 2012," <http://eprassociation.ca/ar/en/2012/EPRA2012%20-%20Annual%20Report.pdf>, 2012.

¹¹ Ibid.

¹² Ibid.

¹³ Electronic Products Recycling Association, "Annual Report 2012," <http://eprassociation.ca/ar/en/2012/EPRA2012%20-%20Annual%20Report.pdf>, 2012.

¹⁴ Ontario Electronic Stewardship, "2012 Annual Report," <http://www.ontarioelectronicstewardship.ca/sites/all/files/annualreport/2012/index.html>, 2012.

¹⁵ Alberta Recycling Management Authority, "The Promise of Environmental Stewardship: 2012/2013 Annual Report to the 2012-2015 Business Plan," <http://www.albertarecycling.ca/docs/annual-reports/2012-2013-alberta-recycling-annual-report---the-promise-of-responsible-environmental-stewardship.pdf?sfvrsn=0>, 2013.

Kilograms Collected/Capita	4.8	4.67	2.85	5.61	4.97	4.44
# of Collection Sites	142	325**	72	444	37	6
Population Awareness (%)	75	80	89	67	79	69
Program Cost/Tonne (\$)	1,208	1,117**	1,822	1,105	1,269	1,393

*Data is collected from 2012 annual reporting

**Data represents fiscal year 2011-2012

As shown in Table 4, multiple indicators (e.g. tonnes collected, number of collection sites, population awareness, program cost, etc.) are taken into consideration to assess the overall effectiveness and performance of EPR programs. Each program has a different approach to reach its performance targets and for this reason, a comparison of programs does not reflect the individual program effectiveness. Despite the many indicators, there is still much variability in the cost and effectiveness of programs.

While cross-province comparisons are not possible, we note interesting facts about some province's recent performance:

- Ontario had the highest overall collection rate (amount of material collected for recycling compared to the amount available for collection) in 2012. Not only did it collect more material, both per capita (5.61 kg) and in total (75,702 tonnes), than any other province, it also exceeded its previous year's collection total by 45%.
- Having collected nearly 22,000 tonnes of WEEE in 2012 through its 142 collection sites, British Columbia's collection rate was the second highest in Canada. Most notably, it exceeded its collection target by nearly 3,000 tonnes. According to the EPRA, British Columbia's 2012–2016 stewardship plan, the program aims to maintain a 3-year rolling average of a minimum of 18,000 metric tonnes of program material collected per year beginning with the year 2011. British Columbia has the most extensive list of obligated electronic products.
- Alberta Recycling's 2011 – 2014 business plan includes targets for the collection of currently eligible electronic waste. Specifically, the target for 2012-2013 was to collect 18,364 tonnes of WEEE, equating to 5.02 kg/capita¹⁶. Despite having the most restricted scope of obligated electronics products and falling short of meeting its target by just over 1,000 tonnes, Alberta had the third highest overall collection rate in Canada with 336 collection sites in 2012.
- With a total of 3,080 tonnes of material collected, Saskatchewan had the lowest per capita collection rate in Canada, yet it reported a high level of population awareness. In

¹⁶ Alberta Recycling Management Authority, "2011/12 – 2013/14 Business Plan," <http://www.albertarecycling.ca/docs/business-plans/2011-2014-business-plan.pdf?sfvrsn=2>, accessed 21 October 2013.

contrast, having a similar population size and almost half the amount of collection sites, Nova Scotia's per capita collection rate was the second highest in 2012.

Overall, provincial programs are improving in performance year after year. The Canadian experience shows that a diversity of collection approaches, consumer outreach strategies, infrastructure facilities and market access can work and co-exist. Results have shown that regulating authorities need to take into account the many factors that can influence program performance in their respective jurisdiction.

Environmental Protection and Design for the Environment

While the broader benefits of diverting materials from landfills are documented through various other studies, it is complex to attribute specific benefits to the implementation of EPR programs.

Measuring the impact of WEEE programs on the prevention of waste and natural resource use requires comparing the environmental impacts of manufacturing new products using virgin materials versus recycled materials. It is understood that using secondary feedstock in place of virgin materials avoids many of the activities and environmental impacts associated with primary resource extraction. Avoiding these upstream activities (e.g. mining, smelting, transporting, etc.) significantly reduces energy usage, greenhouse gas (GHG) emissions, and other pollutant emissions. By using materials recovered from the recycling process, environmental impacts resulting from mining and energy use are minimized. In addition, significant environmental benefits are achieved when materials containing toxic substances are sent to recycling processes and diverted from landfills.

In Canada, while most programs have specified collection targets, there are no specific incentives in the existing provincial WEEE regulations for producers to address DfE. Design changes appear to be most responsive to the emergence of Reduction of Hazardous Substances (RoHS) type regulations initiated in the European Union and other targeted toxics reduction initiatives, as opposed to general EPR regulations. No province has yet to implement regulations requiring that electronics producers use a certain percentage of RoHS-compliant components in their products. Moreover, there are no regulatory requirements for electronics to contain a certain percentage of recyclable components (see section Challenges and Lessons Learned).

c. Cost Effectiveness

Overhead Costs

Overhead costs of the system include general administration costs, oversight and monitoring costs, education costs, and costs for enforcement. Generally, overhead costs are said to account for approximately 15-25% of the overall program costs¹⁷ (see Table 5). Table 5 below provides a summary of the estimated overhead costs for each program where data was available.

¹⁷Dessau, "Inventory and Feasibility Assessment of Electronic Waste Recovery in the Northwest Territories," *ICare*, http://icarenwt.ca/uploads/files/final_report_068-p0000378-0100-mr-0100-01_dec_10_2012.pdf, December 2012.

Table 5: Provincial WEEE Programs Overhead Costs per Tonne (2012) (in Canadian dollars)¹⁸

Province	Overhead Cost per Tonne
British Columbia	\$126.00
Alberta	\$267.00*
Saskatchewan	\$432.00
Ontario	\$75.00
Nova Scotia	\$294.00
Prince Edward Island	\$479.00

*This data is from 2011-2012.

Financial Liability

The success of consumer outreach campaigns and effective collection approaches creates a situation where programs and EPRA (as the PRO) are exposed to the risk that more WEEE will be returned than anticipated or budgeted. Because it is difficult to anticipate the capture rate of old and orphan products, in order to ensure coverage of the financial liabilities of the producers, the EPRA Board of Directors has established an Operating Contingency Fund. It is EPRA's goal to accumulate the equivalent of one year of projected operating costs in the fund so that if an operating deficit occurs, enough money can be transferred to the general fund to cover the current year's deficit (Note: There is no cross-subsidization of funds between jurisdictions)¹⁹. All surplus of revenue over expenses not used for the purchase of capital assets and after transfers to the Effectiveness and Efficiency Fund (described below) are transferred to the contingency fund until the targeted amount is reached. Similar measures to ensure the financial sustainability of Alberta's program – a non-EPRA program – have been taken by the Alberta Recycling Management Authority.

Another way in which stewardship organizations ensure coverage of the financial liabilities of producers is by ensuring that there are enough stewards in the program so that the concentration of credit risk is reduced²⁰.

Effectiveness and Efficiency Fund

EPRA also maintains an "Effectiveness and Efficiency Fund" to promote best practices for the collection, transportation and processing of WEEE and to ensure overall continued reduction of the environmental impact of the EPRA program. The fund is used to financially support the enhancement of non-funded program elements, such as ensuring that there is adequate capacity to properly handle end-of-life electronics collected through the program, providing improvements to the metrics of the program and ensuring that best practices are employed for the handling of substances of concern. Up to 10% of direct operational expenses incurred by the

¹⁸ Based on provincial Annual Reports listed in footnotes 10-15 on page 14 above

¹⁹ Electronic Products Recycling Association, "2012 Annual Report," <http://eprassociation.ca/ar/en/2012/EPRA2012%20-%20Annual%20Report.pdf>, accessed 21 October 2013.

²⁰ Ibid.

EPRA are transferred to the fund annually when there is an excess of revenue over expenses in the year.

d. Additional Benefits

Health

When operated in accordance with environmental, health and safety standards, WEEE recycling programs can generate significant benefits, many of which have not been monetized, for society. By far, the greatest societal benefits from EPR arise from the avoided impacts in terms of human health and environmental damage²¹. While it is difficult to monetize such benefits, placing a monetary value on them allows for a full-cost accounting of the true impact that WEEE diversion programs can have in terms of cost savings to society associated with the reuse of materials and the avoidance of pollution from various materials' life-cycle stages such as raw materials extraction, product manufacturers and waste disposal²².

WEEE diversion programs can also contribute to human health policy goals. While the full scope of benefits should be measured worldwide, an Ontario study calculated values for specific benefits associated with recycling in that province. Avoided human health impacts were estimated at \$18,135 for every tonne of WEEE recycled, which took into account the combined value of the benefits associated with the reductions in human toxics (\$160 per tonne), carcinogens (\$4,175 per tonne), and anthropogenic releases of coarse particles, fine particles, and particular precursors that are known to exacerbate respiratory conditions (\$13,800 per tonne).

Economic

Although the majority of economic benefits associated with WEEE management are direct, there are important indirect and induced impacts associated with the handling of these materials. While some of these commercial activities existed prior to the implementation of EPR programs, their scope and capacity to handle a broader range of products continues to grow in Canada. The more profitable recycling streams are, to a certain degree, supporting the recycling/recovery activities of often less profitable ones, which may not have emerged on their own if not for EPR requirements. The resources spent on recycling and refurbishing these materials, as well as the money recovered through material sales, adds value to the Canadian economy by offering an environmental service that is valued by society, extending the useful life of certain electronic products, and recovering valuable materials that can be used as inputs by

²¹ Morris, J., Morawski, M., and Matthews, S., "Measuring the Environmental Benefits of Ontario's Blue Box, MHSW, and WEEE Diversion: Final Report," *Ontario Ministry of Environment*, http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_108743.pdf, 19 May 2009.

²² Ibid.

other industries²³. All of these activities support a domestic recycling capacity, infrastructure and jobs that generate labour income.

In 2008, a study was conducted to examine the economic impacts of British Columbia's *Recycling Regulation*.²⁴ Estimated total employment generated by electronics recycling in that province was estimated at just over 123 full-time equivalents (FTEs) in 2007. These jobs are distributed across the stewardship organizations (4%), collection depots/consolidation warehouses (69%), primary processors in British Columbia (21%), and transportation (5%) (Note: Percentages are rounded).

In addition to job creation, provincial WEEE programs contribute to economic growth. In 2007 alone, WEEE management of Phase 1 materials added over \$110,000,000 to the province's gross domestic product (GDP). To break it down, for every tonne of material diverted from landfill, \$4,150 of total value is created; \$1,942 of value is directly created by industries involved in the management of WEEE; \$590 is indirectly created by industries involved in the management of WEEE; and \$1,569 is created by induced consumer spending. Significant direct cost savings are also incurred by municipalities as a result of diversion.

V. Supporting Measures

Despite successful results of EPR programs in most provinces across Canada, there is a growing recognition that EPR policies alone may not be sufficient to increase diversion of electronic waste from landfill. This is especially true in a relatively small market like Canada. In order to achieve the objectives of EPR, which include among other things, shifting the financial burden of managing end-of-life products from municipalities and taxpayers to product producers and consumers, it is often necessary to implement supporting and reinforcing measures at the municipal, provincial, and federal level.

a. Consultations

Understanding the capacity and interests of stakeholders (consumers and industry) is key to guiding the effective design and implementation of an EPR program. At the same time, consultations can start building awareness of the changes ahead and start mobilizing needed capacity and partnerships. In Canada, development of EPR regulations is subject to public consultation according to the regulatory development process established in each jurisdiction. Once in place, the governance structures that are established to oversee the programs can be required to consult on different aspects of the program. For example, under the Alberta program, the supporting bylaws allow for the appointment of "Industry Councils", that provide advice and recommendations to the Board of Directors on Business Plans, Budgets, Annual Reports and Program Reviews related to their specific designated material. Representation on the Electronics Recycling Alberta Industry Council includes two electronics manufacturers; two

²³ AECOM, "The Economic Benefits of Recycling in Ontario – Final Report," *Ontario Ministry of the Environment*, http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_108739.pdf, 23 September 2009.

²⁴ Gardner Pinfold Consulting, "Economic Impacts of the B.C. Recycling Regulation," <http://www.env.gov.bc.ca/epd/recycling/resources/reports/pdf/econ-impacts-recycle-reg.pdf>, 31 August 2008.

electronics retailers (2); one supplier of electronics; and one municipality and one Government of Alberta.

b. Standards

Standards play a vital role in the establishment of industry best practices for managing WEEE. They set minimum requirements for operations, for areas that include environmental, health, and safety management systems (EHSMS); legal requirements; data security; emergency planning and response; audit requirements; and environmental, health, and safety controls for collection, treatment, and downstream handling.

In order to become an approved WEEE recycler or processor under any of the provinces industry-led recycling programs, the primary recyclers’ operations, as well as those of all downstream recyclers that handle material associated with or generated from the EOL electronics, must undergo an assessment and receive approval from the Recycler Qualification Office (RQO). The RQO operates under Electronic Products Recycling Association (EPRA), a national, non-profit entity created by Canada’s electronics industry. The RQO manages all recycler assessments and approvals for the regulated provincial programs and uses the Recycler Qualification Program (RQP) as its governing base standard.

The aim of the RQP, which sets out the minimum criteria for WEEE processors and recyclers to be considered for use under the provincial electronics recycling program, is to ensure that waste electronics are managed in a manner that is protective of the environment and worker’s health from the point of primary processing through to final disposition²⁵. Recyclers are assessed against the criteria laid out in the EPSC Electronics Recycling Standard (ERS), which includes, but is not limited to, environmental, legal, occupational health and safety, and material handling requirements. Examples of the controls that recyclers must have in place in order to become RQO approved are provided in Table 6.

Table 6: Examples of controls under the Recycler Qualification Program’s (RQP) Electronics Recycling Standard (ERS)

Category	Requirement
Environmental	<p>4.3 Maintain a documented procedure for the safe handling of substances of concern, and any hazardous materials and wastes, including labelling and storage requirements</p> <p>4.53 Incineration without energy recovery is not permitted for any materials</p> <p>4.54 Export of materials or components is only permitted to downstream vendors located in a country legally permitted to accept the material or component as determined by the authority of the importing country</p>

²⁵ Electronics Product Stewardship Canada, “Recycler Qualification Program for End-of-Life Electronics Recycling,” <http://www.epsc.ca/Documents/Recycler%20Qualification%20Program%20FINAL%202010.pdf>, 27 October 2010.

Health and Safety	<p>5.3 Implement a program for the proper use and care of Personal Protective Equipment (PPE) to reduce exposure to hazards such as noise, dust, and flying objects with provisions to:</p> <ul style="list-style-type: none"> ○ 5.3.1. Provide and enforce the use of necessary PPE ; ○ 5.3.2. Ensure that PPE is appropriate, properly rated, and fit-test to individual needs where required; and ○ 5.3.3. Post notice of areas requiring the use of PPE. <p>5.5 Maintain a lock-out tag program to ensure that mechanical and electrical equipment remains in a de-energized state during any setup, cleaning, maintenance, or other activity that may require the removal of physical guards or other worker access to a hazardous area.</p> <p>5.7 Maintain a process for the safe removal and replacement of filters from processing equipment ventilation systems to prevent exposure to dusts and particulate.</p>
Operational	<p>6.1 Maintain a process to track and report the quantity and chain of custody of program materials received, processed, and shipped, as well as provide certificates of recycling for all material once processed.</p> <p>6.2 Maintain effective procedures and security measures to prevent:</p> <ul style="list-style-type: none"> ○ 6.2.1. Unauthorized access to the premises and storage areas, and ○ 6.2.2. Unapproved removal of any material or equipment from the facility. <p>6.3 Ensure that all processing is conducted indoors.</p> <p>6.4 Ensure that all Substances of Concern are stored indoors.</p> <p>6.9 Maintain a contingency plan for handling Stewardship Program materials in the event the Recycler is unable to process materials or ship to an approved Downstream Recycler</p>

Besides the RQP, the RQO also administers the Electronics Reuse and Refurbishing Program (ERRP) and the Collection Site Approval Program (CSAP). Aimed at supporting responsible environmental, safety, and social management practices related to the reuse and refurbishing of WEEE, the Electronics Reuse and Refurbishing Standard (ERRS) specifies minimum requirements for companies engaged in reuse and/or refurbishing activities and wishing to be recognized by the stewardship program²⁶. In a similar way, the CSAP seeks to ensure that all designated materials are handled in a responsible manner and does this by laying out minimum criteria that collection sites must demonstrate conformance with in order to operate on behalf of an EPRA program (all programs except for Alberta's)²⁷. In addition to those developed by the RQO, some provinces have developed their own set of standards for their service providers.

As noted earlier, a level playing field is critical to ensuring and encouraging fair competition in an EPR system. To achieve this, provincial program operators use a competitive tender process when selecting processors to manage their WEEE. Processors must meet the EPR processor guidelines and are audited against it.

²⁶ Electronic Products Recycling Association, "Electronics Reuse and Refurbishing Program," www.rqp.ca, 10 May 2012.

²⁷ Electronic Products Recycling Association, "End-of-Life Electronics Collection Site Approval Program," www.rqp.ca, 10 May 2012.

Table 7: Material Disposition Hierarchy, and Acceptable Processes and Points of Final Disposition

		Disposition Hierarchy			Acceptable Processes & Points of Final Disposition							
		Material Recovery Required	Energy recovery Permitted	Other disposition Permitted	Manual dismantling and material separation	Mechanical material separation	Extraction/purification/refinement	Smelting to reclaim metal	EFW Incineration (use of material as an energy substitute)	Landfill	Hazardous Waste Landfill	Export to a non-OECD/EU country for processing
Electronic Scrap	EOLE	★			✓	✓	✗	✗	✗	✗	✗	✗
	Components (hard drives, chips, etc.)	★			✓	✓	✓	✓	✗	✗	✗	✗
	Wires / Cables	★			✓	✓	✓	✓	✗	✗	✗	✗
	Copper Yokes	★			✓	✓	✓	✓	✗	✗	✗	✗
	Circuit Boards	★			✓	✓	✓	✓	✗	✗	✗	✗
	Metal / plastic laminates	★			✓	✓	✓	✓	✗	✗	✗	✗
Non Hazardous	Metal	★							✗	✗	✗	✗
	Mixed Metals	★							✗	✗	✗	✗
	Metal dusts (bag house)	★							✗	✗	✗	✗
	Non-leaded Glass	★						✗	✗	✗	✗	✗
	Plastic		★	★				✗			✗	✓
	Mixed Plastics		★	★				✗			✗	✓
	Wood		★	★				✗			✗	✗
	Leather, cotton and other fibres		★	★				✗			✗	✗
	Insulation (Fibreglass / composite)		★	★				✗			✗	✗
Substances of Concern	Leaded Glass	★			✓	✓	✓	✓	✗	✗	✗	✗
	Washed leaded glass cullet	★			✗	✓	✓	✓	✗	✗	✗	✗
	Mercury Lamps	★			✗	✓	✓	✗	✗	✗	✗	✗
	Mercury	★			✗	✓	✓	✗	✗	✗	✗	✗
	Batteries	★			✗	✓	✓	✓	✗	✗	✗	✗
	Ink / Toner Cartridges		★		✓	✓	✓	✓	✓	✗	✗	✗
	Ink / Toner		★		✗	✓	✓	✗	✓	✗	✗	✗
	Phosphor Powder			★	✗	✓	✓	✗	✗	✗		✗
	Ethylene Glycol			★	✗	✓	✓	✗	✗	✗		✗

In accordance with the Disposition Hierarchy material recovery is always preferential over other disposition methods for all materials but only required where indicated with an '★'.

Where the use of the material for energy recovery, or other disposition methods is permitted, they are indicated with an '★'.

Process/application not permitted under the ERS	✗
Process/application is permitted under the ERS & subject to on-site audit	✓
Process/application is permitted under the ERS & subject to document review and verification	

c. Disposal/Landfill Bans

One of the most effective supportive measures to an EPR policy is a disposal/landfill ban because it effectively closes the door to disposal options. Provincial landfill bans for WEEE are currently in place in three provinces: Nova Scotia, Prince Edward Island, and Newfoundland. In other provinces, municipalities have set more ambitious goals for increasing diversion and preventing hazardous chemicals from making their way into local landfills by beginning to implement a number of supportive and reinforcing policies to EPR. In provinces where province-wide bans are not in place, municipalities can also take the initiative, and implement bans using local bylaws. For example, Ontario municipalities with landfill bans on WEEE, for example, cover about 53% of the Ontario population. Table 8 below describes specific examples of cities that have implemented successful landfill bans on WEEE.

Table 8: Examples of municipal landfill bans on WEEE

City	Description
City of Waterloo, Ontario	Effective June 6, 2005, WEEE set out for curbside collection is rejected and stickered with details of the WEEE-recycling program ²⁸ . In addition to the curbside collection ban, vehicles using the small vehicle transfer stations or landfill site that are found to contain WEEE are required to separate the WEEE from the rest of the load and pay the necessary fee. Examples of banned e-waste include: answering machines, calculators, cameras (35 mm or digital), cell phones, televisions, printers, photocopiers, VCRs, video game controllers, fax machines, DVD players/writers, computer mouse, keyboard, laptop computer, and satellite receiver ²⁹ .
Metro Vancouver, British Columbia	All electronic and electrical products identified in Schedule 3 of the province's <i>Recycling Regulation</i> are prohibited. This includes, among other items, computers, copying equipment, dishwashers, electronic tools, clothes washers and dryers ³⁰ . E-waste landfill bans are also in place throughout the Kitimat-Stikine Regional District, Central Okanagan Regional District, Nanaimo Regional District, Cowichan Valley Regional District, and the Capital Regional District ³¹ .
City of Whitehorse, Yukon	Even though the Yukon Government has yet to add electronics to the existing designated materials regulation, the City of Whitehorse has restricted the disposal of WEEE in landfills. Under the city's Waste Management Bylaw, the following electronic waste is banned from landfill: handheld devices (i.e., calculators, cell phones, pagers, portable cameras, etc.), audio equipment (i.e., AM/FM radios, amplifiers, video recorders, projectors, etc.), computer equipment (i.e., desktop computers, laptops, central processing units, mouse, keyboard, etc.), and televisions ³² .

²⁸ Region of Waterloo Transportation and Environmental Services, "Report: E-04-092 Electronics (E-Waste) Diversion Program," <http://www.regionofwaterloo.ca/en/aboutTheEnvironment/resources/E-04-092.pdf>, 1 June 2004.

²⁹ Region of Waterloo, "Other recycling programs," http://www.regionofwaterloo.ca/en/aboutTheEnvironment/Other_Recycling_Programs.asp, 2010.

³⁰ British Columbia, "B.C. Reg 449/2004 - Environmental Management Act: Recycling Regulation," http://www.bclaws.ca/Recon/document/ID/freeside/449_2004, 2004.

³¹ Electronics Product Stewardship Canada, "Design for Environment Report 2013," http://media.wix.com/ugd/5deafb_128f03d75b0f72c1437b86e34f8e7bea.pdf, 2013.

³² City of Whitehorse, "Office Consolidation of Waste Management Bylaw 2012-30," <http://www.city.whitehorse.yk.ca/modules/showdocument.aspx?documentid=71>, 2012.

d. Complementary Provincial and Federal Initiatives

Provincial Level

Table 9 lists some examples of initiatives implemented by provinces in place to support producer responsibility objectives.

Table 9: Examples of provincial initiatives in place to support producer responsibility objectives

Type of Initiative	Description
Procurement Policy	Nova Scotia’s government-wide policy ensures that where feasible, government purchases meet UL Environment’s EcoLogo Certification Standards. The logo identifies products and services that have been independently certified to meet strict environmental standards that reflect their entire life cycle, from manufacturing all the way through final disposal.
Source Separation	Nova Scotia mandates source-separation of materials for recycling such as WEEE and organics. Prince Edward Island (P.E.I.) has also established a mandatory source separation program to help reduce the amount of waste going to landfill by requiring residents and businesses to source separate their waste into three streams: recyclables, compostables, and waste.
Landfill Levy	<p>In addition to regular tipping fees, Manitoba has adopted a landfill levy of \$10.00/tonne³³. The collected funds are placed in a dedicated fund for waste reduction and recycling initiatives. Although the levy does not target WEEE specifically, as it is charged on <i>all</i> waste going to landfill (not just electronics), it is expected to increase WEEE diversion nonetheless as a result of the financial incentive to recycle.</p> <p>In 2012, the province of Quebec introduced a landfill levy of \$20.69 per tonne for materials (this is in addition to tipping fees)³⁴. The levy, which is not specific to electronics, has two components: a permanent levy that is currently at \$11.19 per tonne; and a “temporary” levy of \$9.50 per tonne.</p>

Federal Level

The Government of Canada developed the Chemicals Management Plan (CMP) to improve the degree of protection against hazardous chemicals. Under the CMP, the Government of Canada is working closely with health and environmental groups, consumer groups and industry to reduce risks to Canadians and our environment by setting clear priorities for the assessment and management of hundreds of chemicals. This could apply to waste management when there is a potential for release of a toxic substance to air, land, or water. These substances are often managed at waste treatment or disposal facilities, as part of manufactured items and products, at their end of life. Current federal initiatives that may be relevant to electrical and electronic

³³ Kelleher, M., “Landfill Levies: Different Jurisdictions Use Levies to Achieve Specific Outcomes,” *Solid Waste and Recycling Magazine*, <http://www.solidwastemag.com/news/landfill-levies/1002463779/>, 1 February 2013.

³⁴ Ibid.

equipment include the development of regulations respecting mercury in products and the development of risk management approaches for PFOA and long-chain PFCAs, as well as for products containing PBDEs.

In addition, Canada has implemented regulations to control the export and import of hazardous materials according to its obligations under the Basel Convention and as a member of the OECD. Under the *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* adopted under Section 191 of the *CEPA*, hazardous waste and hazardous recyclable materials that are moved across international borders require a valid permit. Permit requirements include that hazardous material be recycled and disposed of at authorized facilities and that all transboundary shipments of these wastes be tracked until they reach their final destination. As well, the regulations require that written confirmation of disposal or recycling be given.

As a complement to EPR, in February 2010, Public Works and Government Services Canada established a government-wide e-waste strategy to deal with all federal surplus EEE³⁵. The strategy seeks to ensure that government departments and agencies across the country have access to disposal mechanisms for WEEE. The “Guideline for the Disposal of Federal Surplus Electronic and Electrical Equipment” was developed to articulate the strategy. Emphasizing reuse first, government donates surplus computers and related equipment to Industry Canada’s Computers for Schools program³⁶. Other types of information technology that are still functional are sold to members of the public through PWGSC’s Crown Assets Distribution. In other cases, equipment may be donated to charities. All of these programs extend the useful life of EEE, delaying disposal to landfill and consumption of virgin material and energy to manufacture new EEE.

e. Consumer Awareness

Promotion, education, and communication programs are key elements included in the cost of delivering electronics recycling programs. In Ontario, 3.97% of EHF revenue is used to promote and educate consumers and businesses on where and how they may drop-off their WEEE at no charge³⁷. In addition to consumer brochures, Ontario Electronic Stewardship (OES) runs print ad campaigns telling consumers that “it’s time they (WEEE) move out of the basement.” The OES also produces video vignettes, which can be viewed on the organization’s website.

Given its responsibility to raise public awareness about the importance of recycling WEEE, EPRA-Quebec sponsored the province’s Waste Reduction Week in 2013³⁸. As part of its involvement as a main sponsor, the organization helped produce a humorous and educational video on electronics consumption and how to dispose of it in an environmentally and socially responsible manner.

³⁵ Weber, C., “Waste not, want not: A strategy for e-waste,” *Canadian Government Executive*, <http://www.canadiangovernmentexecutive.ca/category/item/269-waste-not-want-not-a-strategy-for-e-waste.html>, 7 May 2012.

³⁶ Ibid.

³⁷ Ontario Electronic Stewardship, <http://www.ontarioelectronicstewardship.ca/your-role/consumer-business>, 2013.

³⁸ Electronics Product Recycling Association, “Participation in Quebec Waste Reduction Week 2013,” <http://recyclemyelectronics.ca/qc/news/participation-in-quebec-waste-reduction-week-2013/>, 2013.

In order to draw attention to the program and to educate the public on the importance of safe electronics recycling, in 2012, Saskatchewan established the “Why are you holding onto it?” campaign³⁹. As part of the campaign, a full length animated video was developed and put on the program website. In addition to being used in presentations and schools, the video is featured on many SARCAN (a division of the Saskatchewan Association of Rehabilitation Centres (SARC)) public video display terminals throughout the province. At the end of the first fiscal year of running the campaign, the majority of Saskatchewan residents (70%) reported having recycled WEEE at least once or having donated such items (61%) over the past year.

Green Manitoba, a special operating agency, acts as an access point for public information. It serves as a catalyst, knowledge portal and service delivery agent for government departments and a wide range of public and private sector organizations to help create a cleaner and greener Manitoba. The Agency has continued to strengthen its role as the central hub for the public and private sectors to access information about provincial sustainability initiatives, which oversees extended producer responsibility programs on behalf of the Manitoba Government.

In addition to the communication programs established by producer responsibility organizations (PROs), visible environmental handling fees (EHFs) acts as an educational tool because they send a clear signal to consumers at the point of purchase that there are environmental and financial costs associated with recycling WEEE. Refer to Table 4 for population awareness percentages in each province.

In an effort to inform and educate the public on EPR initiatives across the country, Environment Canada operates and maintains the Extended Producer Responsibility and Product Stewardship Inventory of Programs. The inventory, accessible online, provides the public with information on program scope (i.e. what products are designated under legislation); collection mechanism and location (i.e. how products are collected and where they can be dropped off); program performance and goals; product specific fees; policies, monitoring and reporting; and who to contact for further information.⁴⁰

VI. Challenges and Lessons Learned

The implementation of EPR Programs for WEEE has been a major endeavor in Canada that has contributed to the development of a solid and growing infrastructure that collects WEEE and ensures its appropriate management and recovery. The establishment of the industry-led EPSC to manage the programs has allowed regional differences to co-exist and be managed effectively. As with any endeavour of this size and complexity, there continues to be room for improvement as both regulators and industry acknowledge the successful elements of the various programs and those aspects that need to be improved. Performance based regulations

³⁹ SWEEP, “Annual Report 2012-2013,” http://www.recyclemyelectronics.ca/sk/wp-content/uploads/2013/08/SWEEP_AnnualReport2012_WEB.pdf, 2013.

⁴⁰ Government of Canada, “Inventory of Programs,” <http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=9FB94989-1>, 3 July 2012.

with a good range of flexibility and opportunity for dialogue and innovation are important to the continuation of successful programs.

Over recent years, Canadian provinces have had several opportunities to reflect on experiences and issues faced with EPR programs since the implementation of the Canadian-Wide Action Plan on EPR in 2009. These opportunities have included an EPR meeting in 2012, during which federal and provincial governments convened to share lessons learned, concerns, and solutions; a CCME *State of Waste Management in Canada Report*, which identifies some key opportunities for improvements; and the CCME five-year review of the Canada-wide Action Plan (CAP) for EPR, which considers whether materials, timelines, and commitments set in 2009 are still relevant. In addition, the not-for-profit organization EPR Canada was formed in 2011 to help ensure continued growth and improvement of EPR policies, programs, and practices in Canada. In 2012, the organization launched the concept of an EPR Report Card, which gives a grade to the federal, provincial, and territorial governments on their progress in developing and implementing EPR legislation in compliance with the CCME CAP for EPR.

a. Harmonization

Despite many shared standards and policies, the independent operation and administration of provincial WEEE programs in the beginning was not ideal. In addition to creating significant policy and operational inefficiencies, it led to reduced service quality for program members and higher costs⁴¹. In response to this problem, a new governance structure to streamline electronics stewardship programs across the country was developed by Electronics Product Stewardship Canada (EPSC) in partnership with the Retail Council of Canada (RCC). EPRA is now responsible for managing electronics recycling programs in every province except for Alberta and New Brunswick.

This transition has generated multiple benefits for both stewards and consumers, including: streamlined administrative processes and lower administrative costs; lower operational costs; consolidated communication to members to minimize duplicate messaging; lower unit costs for shared services, due to distribution over more programs; and improved service quality⁴².

b. Consumer Access

Consumer access in each jurisdiction is very well measured annually through EPRA's two indicators: (1) the percentage of population within a specific driving distance of a collection depot; and (2) the number of collection sites. While access has reached at least 92% in several provinces (British Columbia, Saskatchewan, Quebec, Nova Scotia, and Prince Edward Island), authorities continue to strive to improve the reach of the EPR programs and service to rural and remote communities.

In provinces with an EPR program for WEEE, all consumers pay environmental handling fees (EHFs), however, rural residents have fewer opportunities to participate in electronic take-back

⁴¹ Electronics Product Recycling Association, "Annual Report 2012," <http://eprassociation.ca/ar/en/2012/EPRA2012%20-%20Annual%20Report.pdf>, accessed 20 October 2013.

⁴² Ibid.

programs because many rural areas do not have recycling depots or business designated or able to take-back materials. Several factors make operating a WEEE collection and recycling program in a rural area considerably more difficult than in an urban location: the lack of infrastructure, the unit costs associated with collecting materials are disproportionately higher in rural communities, the long distances and the resulting high transportation costs, low population densities, as well as legislative barriers. So far, one solution has been to provide rural and remote area residents with access to a place to drop off their electronics on an annual basis.

The Northwest Territories, Yukon and Nunavut face the additional challenge of not being able to rely on large and profitable urban programs to support the development of infrastructure in remote areas. The CCME recognized their unique circumstances with respect to small populations, vast distances between remote communities and long product-supply lines. Discussions and work continues to establish the necessary partnerships to assist in opening further opportunities for EPR in northern Canada.

c. Financing and Fees

The long-term political and public acceptability of EPR programs depends in large part on their financial sustainability. This is exemplified by the prominence of public reporting and third-party audits required by authorities and/or EPR regulations. Public accountability for the funds collected through EHF fees and the cost of program operations makes financial sustainability an important concern for program administrators. In sum, EPR programs are businesses set up to achieve waste diversion objectives.

The structure of fees and the ability of programs to adapt to the changing WEEE product streams are paramount. In early days of any EPR program, a certain amount of orphan products (before EPR programs were in place) can be expected to be collected. Fee setting methodologies allow for such contingency to be funded via EHF and this approach is effective in assuring a positive interface with consumers as programs try to increase participation rates as well as deal with old products no longer in use by consumers. In order to gain acceptability, it is advantageous that programs offer the broadest range of collection services.

Another issue affecting financial sustainability is the weight-based fee structure. Rapid technological change, significant light-weighting of products and evolution of multifunctional devices require that regulations allow for the timely adjustment of product listing and related fees (Table 11 in Annex shows the average unit weight comparison of electronics in 2009 and 2014). PROs may be faced with the management of increased quantities of WEEE with less funding to run the programs if programs face regulatory constraints in adjusting their fee structures to compensate for financial losses to processing lighter electronic products.

Transparency and accountability have been essential elements for public acceptance of these new initiatives and the introduction of new EHF at the point of purchase. There remain varying preferences among provincial authorities concerning the visibility of fees in the advertised prices. There are numerous examples of EPR programs across Canada for different products, including WEEE, that operate with visible and non-visible fees. Most provincial environmental authorities have had to gauge the consumer acceptability of one or the other approach in their respective

provinces. In the end, the variety of approaches no doubt presents a challenge for industry, in particular retailers selling designed products in many provinces.

d. Procurement and Competition

One principle underlying EPR legislation is ensuring a level playing-field among industry stewards that encourages competition and innovation while ensuring that waste diversion objectives are met and that program compliance is achieved. This can pose challenges in a federation like Canada where EPR program requirements have been developed and implemented individually by provincial authorities. National definitions and principles for electronic stewardship⁴³ developed by the Canadian Council of Ministers of the Environment (CCME) have provided a consistent frame of reference for provincial authorities in the development of their EPR regulations.

In some provinces, EPR regulations offer producers flexibility in deciding how they will fulfill their stewardship obligations (i.e., collectively or individually). These types of regulations permit new PROs or individual steward programs to enter the market and for competition to reduce costs. If a new PRO or individual producer can provide comparable take-back services at a reduced cost, there is nothing preventing them from doing so. In practice, however, once large PROs have formed, economies of scale can make it difficult for smaller operators to compete. Flexible performance-based EPR regulations help foster competitiveness to the extent that they allow companies to find more cost-effective ways of meeting their requirements. This a particularly attractive feature for this product category considering the steadily changing products, markets, evolving infrastructure and recovery technologies characterizing the WEEE sector.

e. Environmental Performance Measurement

Stewards' annual reports offer accurate information on how much WEEE is collected via Canadian EPR programs and therefore diverted from landfills. What is more difficult to quantify is actual amounts and types of materials recycled or otherwise recovered.

In Canada, as elsewhere in the world, WEEE EPR programs' performance has focused on tonnage of collected materials or capture rates. While these measurements are useful, more should be done to expand the understanding of the benefits of these programs through a more comprehensive collection of information on their performance. For example, weight measurements have their limitations: they offer no information regarding the composition and toxicity of WEEE, nor do they take into consideration the fact that weights of products are always changing. In fact, recent trends towards light-weighting, miniaturization, and multi-function EEE suggest that, over time, overall WEEE tonnage will decrease once the old equipment stockpiles are captured. Without a diversified set of performance measures, WEEE EPR programs measure may show a declining performance in the future.

⁴³ Canadian Council of Ministers of the Environment, "Canada-wide Action Plan for Extended Producer Responsibility (EPR)," http://www.ccme.ca/assets/pdf/epr_cap.pdf, 2009.

More meaningful performance measurements, specifically, those that relate to the efficiency of the actual recycling process and to the final destination of material, would offer further insights into these programs and where further improvements could be made to increase their efficiency and effectiveness.

f. Design for Environment

With few exceptions, products covered under electronics EPR programs are manufactured outside of Canada. In general, the Canadian marketplace is small for these global products and supplies. The influence of EPR programs on the design of these items is not thought to be substantive. As a leading jurisdiction in the diversion of WEEE via EPR programs, concerns remain regarding how to influence a positive shift towards more sustainable products, efficient resource use and increase recovery of materials.

There are many environmental improvements that can be sought when considering the life-cycle of EEE. Changes in product design have for the most part been in response to specific government regulations or requirements and the need to maintain or gain access to markets where the most stringent standards are in place. Varying objectives (e.g. less toxicity, promotion of material recovery and reuse) have been encouraged via specific dedicated measures.

To date Canadian EPR programs have not provided incentives to reward innovative producers who are designing their products in a more environmentally responsible way. The province of Quebec is working to implement a differentiating fee structure to introduce these rewards but its success in promoting sustainable products and the ability of the PROs to efficiently administer the more complex requirement remains uncertain. Adding reuse or recycling content targets to EEE products via EPR legislation may also be administratively complex to administer and possibly better pursued outside the EPR governance framework as a complementary measure.

g. International Trade

By assuring and stimulating the collection of a wide range of WEEE, EPR programs have created opportunities to increase recycling and resource recovery. Because WEEE recycling is a very competitive business, processors in Canada have cited concerns about their ability to compete and the need for clearer guidance on controls applied internationally to recycled materials exported from Canada.

The regulatory regime that controls the transboundary movement of these products, whether a waste or not, can have an impact on the development of local recycling industries in Canada. The ability to legally export WEEE, or any of its components, has been a concern of domestic recyclers, particularly if those exports are destined to facilities that are not meeting standards for environmentally sound management.

The challenge for regulators with respect to shipments of these materials is that they do not always meet the definition of a waste or exhibit the hazard characteristics that would trigger their control. For this reason, work is underway internationally and domestically to improve

definitions in order to improve the ability for regulators and businesses to determine which materials are to be controlled and under what conditions.

VII. Looking Ahead and Conclusion

The decentralized approach to implementing EPR programs for electronics is a Canadian jurisdictional reality that has been successful, but not without challenges. Each province has tailored an approach to respond to their particular circumstances with slightly different lists of items covered by their respective WEEE regulations. In the future, although the focus thus far has been on WEEE from households, it is expected that the scope of product coverage will continue to expand for existing programs across provinces.

Consumer access, already at a high rate of over 90% in several provinces, continues to expand. By 2015, all provinces are expected to have regulated EPR programs in place in Canada. In addition, the three territories continue to develop diversion options in partnership with producers that are appropriate for their unique situations.

Despite the differing legislative approaches between provinces and the variability of program effectiveness, the Canadian experience with EPR remains effective and efficient overall. With an increasingly amount of WEEE collected year after year, new collection depots established across Canada, and higher consumer awareness in the provinces, EPR programs in Canada have continued to demonstrate success in diverting WEEE from final disposal with the ultimate goal of having producers responsible for the end of life management of their products. In coming years, it will be important for EPR programs to remain financially sustainable, effective in meeting program goals, and supported by the public, while encouraging innovation in a fair marketplace. Looking ahead, it will also become increasingly important for governments and industry stakeholders to continue to work together to expand the scope of performance measurement, to harmonize product definitions, and broaden the implementation of complementary measures (e.g. Landfill bans for electronics) and finally, continue raising public awareness to sustain their involvement and participation in these programs.

VIII. Annex

A. List of Acronyms

ADS	Advanced Disposal Surcharge
CCME	Canadian Council of Ministers of the Environment
CSAP	Collection Site Approval Program
DfE	Design for Environment
EEE	Electrical and Electronic Equipment
EHF	Environmental Handling Fee
EOL	End-of-Life
EPR	Extended Producer Responsibility
EPRA	Electronic Products Recycling Association
EPSC	Electronics Product Stewardship Canada
ERS	Electronics Recycling Standard
ERRP	Electronics Reuse and Refurbishing Program
ERRS	Electronics Reuse and Refurbishing Standard
IPR	Individual Producer Responsibility
ISP	Industry Stewardship Plan
OECD	Organization for Economic Cooperation and Development
OES	Ontario Electronic Stewardship
PRO	Producer Responsibility Organization
R&D	Research and Development
RQO	Recycler Qualification Office
RQP	Recycler Qualification Program
WDA	Waste Diversion Act
WDO	Waste Diversion Ontario
WEEE	Waste Electrical and Electronic Equipment

B. Program Revenues and Expenses

Table 10: Breakdown of program revenues and expenses by program for the year ended December 31, 2012 (in Canadian dollars)

	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	Nova Scotia	Prince Edward Island
Revenues								
Environmental Handling Fees (EHFs)	\$16,644,653	\$12,146,972	\$6,410,688	\$3,388,486	\$58,282,533	\$12,974,079	\$3,412,346	\$446,427
Interest	139,574	10,739					10,057	1,519
Investment Income		7,729,823			177,176			
Other			176,325		150,000			
Total Revenues	\$16,784,227	\$19,887,534	\$6,587,013	\$3,388,486	\$58,609,709	\$12,974,079	\$3,422,403	\$447,946
Expenses								
Direct Operating Expenses								
Processing	\$8,328,081			\$1,113,374		\$4,097,806	\$1,083,982	\$177,237
Handling	3,098,071			349,578		1,030,701	335,579	38,252
Transportation and Storage	2,330,657			333,332		1,702,735	350,187	25,690
Quality Assurance/Recycler Audits	179,087	248,822		60,000		150,000	55,665	8,408
Total Operating Costs	13,935,896	248,822	4,168,486	1,856,284	75,645,372	6,981,242	1,825,412	249,587
Other Expenses								
Consumer Awareness (P&E)	507,249	1,419,756	576,822	397,014	323,557	121,800	100,236	28,293
Research and Development		682,273						
Administration	1,087,040	690,703	532,085	274,858	3,042,365	787,287	311,378	73,811
Government/Professional Fees		1,601,671	222,906	33,491		389,500	0	29,166
Miscellaneous		14,706,654	111,000		2,608,007			66,616
Total Other Expenses	1,594,289	19,101,057	1,442,813	705,363	8,973,929	1,298,587	411,614	131,271
Total Expenses	\$15,530,185	\$19,349,879	\$5,611,299	\$2,561,647	\$83,619,301	\$8,279,829		
Program Deficit/Surplus	\$1,254,042	\$537,655	\$975,714	\$826,839	-\$25,009,592	\$4,694,250		\$1,185,849

Notes: Data for Alberta and Saskatchewan is for fiscal year ended March 31, 2013. All other data is for year ended December 31, 2012. In Ontario, miscellaneous expenses include \$1,044,677 for Waste Diversion Ontario administration and program delivery, and \$1,563,330 for program delivery. No breakdown of operating expenses. In Saskatchewan, miscellaneous expenses refer to effectiveness and efficiency restricted expenses. No breakdown of operating expenses. In Alberta, environmental handling fees (EHFs) are called advance disposal surcharges (ADSs). Miscellaneous expenses include \$14,521,685 for the recycling incentive program and \$184,969 for the rural Alberta project and municipal assistance. No breakdown of operating expenses. It is impossible to determine total expenses for Nova Scotia and Prince Edward Island because the figure reported for program development expenses (\$66,616) is combined.

C. Fee Setting Methodology – A Closer Look

Provided here are examples of the fee-setting methodology to calculate steward fees that are employed by two Canadian provinces (Ontario and British Columbia) under their respective WEEE EPR plans.

Ontario Electronic Stewardship

Each year, Ontario Electronic Stewardship (OES) sets steward fees for industry to fund their share of the WEEE program to recycle their products. On February 19, 2013, Waste Diversion Ontario (WDO) and the Ontario Minister of the Environment approved OES's new fee-setting methodology, as set out in the Minister's letter of February 9, 2012.

WDO was established in 2002 through the *Waste Diversion Act (WDA)* as a non-crown corporation responsible for overseeing the development, implementation, and operation of diversion programs designated by the MOE, including those for electrical and electronic equipment (EEE).⁴⁴

In the province of Ontario, stewards of EEE pay *actual* costs (material management and program costs) based on actual sales into the market. In other words, OES's per unit fees are based on prior calendar year actual costs, and prior year units put on the Ontario market⁴⁵.

As of May 1, 2013, each steward must also make a per unit contribution (by material category) to the OES's operating reserve. The purpose of this reserve is to provide working capital for program growth and to ensure a financially sustainable program. The amount a steward must pay into this reserve is based on the percentage of their prior year operating costs divided by the actual quantities of material supplied into the Ontario market in the prior year.⁴⁶ If the reserve accumulates excess funds, these are used to reduce steward fees for the two subsequent years (Note: There is no cross-subsidization between programs).

The new fee-setting methodology also provides for a per unit debt retirement fee to be charged to all registered stewards in the relevant material category, based on their market share. As of May 2013, there were deficits in two material categories: floor-standing units (copiers, printers, etc.) and "other" WEEE (e.g. computer peripherals, home theatre-in-a-box, telephones, desktop printers, etc.).

To adjust for revenue shortfall in the case that actual costs exceed revenue in a material category in the year, the Ontario cost-recovery model also provides for a reconciliation fee⁴⁷. This fee is expressed as a per unit fee, payable at the same time and in the same manner as current year steward fees. For example, if there was a revenue shortfall in calendar year 2013, a

⁴⁴ Waste Diversion Ontario, "About WDO," <http://www.wdo.ca/about/about-wdo/>, accessed 11 December 2013

⁴⁵ Ontario Electronic Stewardship, "Waste Electrical and Electronic Equipment Program Plan: A New Funding Model," http://www.ontarioelectronicstewardship.ca/sites/all/files/pdf/cost-recovery/weee_cost_recovery_implementation_15_mar13b.pdf, 15 March 2013.

⁴⁶ Ibid.

⁴⁷ Ibid.

reconciliation fee would be applied to units supplied on the Ontario market during the period after May 1, 2014.

It is important to note that, typically, fees paid by stewards are passed on in the supply chain to the consumer at point of purchase. Thus, the EHF paid by consumers on the purchase of new electronic goods offset 100% of stewards' costs for the return of any number of products purchased in the past whether or not it carried a fee or has a Steward still in business in Ontario.

Electronic Products Recycling Association - British Columbia

British Columbia's electronics recycling program is funded by steward fees that are based on a producer's net designated product sales into the province (gross sales minus product returns).⁴⁸ These fees are passed to the consumer in the form of an EHF applied on registered stewards' products.

In addition to financing general program costs (i.e. administration, collection, transportation, etc.) steward fees are used to cover the costs to maintain the program's two reserves: (1) an operating contingency reserve (OCR) to ensure financial stability and smooth program operation through variable economic conditions; and (2) an effectiveness and efficiency fund to allow for investment in continual improvement initiatives.⁴⁹ Again, there is no cross-subsidization of funds between provincial programs.

Based on the results of annual audits of program costs and revenues, steward fees are adjusted each year to ensure that they are no more than is necessary to reflect the ongoing costs of program operation and maintaining adequate reserves.

Electronic Products Recycling Association (EPRA) British Columbia is currently working with stewards to develop new funding methodologies to cover the costs associated with launching new service delivery models such as industry self-management (ISM) for Phase IV products, many of which are already handled by industry.⁵⁰

⁴⁸ Electronic Products Stewardship Canada, "British Columbia Stewardship Plan for End-of-Life Electronics," *British Columbia Ministry of the Environment*, http://www.env.gov.bc.ca/epd/recycling/electronics/pdf/ESABC_plan.pdf, 13 October 2006.

⁴⁹ Electronic Products Recycling Association, "Stewardship Plan 2012-2016," *British Columbia Ministry of the Environment*, http://www.env.gov.bc.ca/epd/recycling/electronics/pdf/epra_bc_stewardship_plan2012.pdf, accessed 19 October 2013.

⁵⁰ Ibid.

D. Comparison of Average Electronics Unit Weights 2009, 2014

Table 11: Average Unit Weights Comparison: 2009, 2014

Material Category		2009 Weight* (kg/unit)	2014 Weight* (kg/unit)
Display Devices	Computer Monitors	7.7	3.3
	Display Devices <18"	6.0	redundant
	Display Devices 18-29"	21.0	2.6 (22" LED TV) 4.2 (28" LED TV)
	≤ 29" Screen Total	11.2	redundant
	Display Devices >29-45"	35.0	18 (42")
	Display Devices >45"	45.0	26 (50") 36 (55")
	>29" Screen Total	37.3	
Desktop Computers		7.4	6
Portable Computers		2.9	1.5 (Ultrabook) 2.4 (Laptop)
Computer Peripherals		1.1	0.9
Copiers and Multi-Function Devices	Desktop	9.6	6.9
	Floor-Standing	100.0	100
Printing Devices	Desktop	9.4	6.9
	Floor-Standing	50.0	100
Telephones and Telephone Answering Machines		1.2	0.94
Cellular Devices and Pagers		0.2	.17 (Smartphone)
Image, Audio and Video Player and Recorders	Personal/Portable	0.8	.2
	Home/Non-Portable	4.9	1.75
	Home Theatre in a Box	22.9	8.3
	Aftermarket Vehicle	2.3	0.5