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IT Waste Management in Canada: From Cost Recovery to Resource Conservation?

Meinhard Doelle[†]

Abstract

The volume, composition and management of solid waste generated by households, governments, the commercial sector, and industry have all changed dramatically over the past century. Household waste contained mainly organic material a hundred years ago. Today, both residential and commercial waste is a complex mix of organics, plastics, paper products, metals and a variety of toxic material. Historically, individual households looked after their own waste, through efforts such as composting and burning. Over the past century, with significant increases in volume of waste generated, municipalities have taken over primary responsibility for solid waste management, initially mainly for aesthetic and sanitary reasons. Environmental considerations only relatively recently factored into waste management strategies, particularly in North America. This article explores the implications of a growing component of waste generated in Canada, waste from electronic equipment such as computers, televisions, and cell phones.

Introduction

The past quarter century has seen the emergence of a new and ever growing source of waste in western societies, waste generated from electronic equipment.¹ The increase of electronic waste is dominated, but not limited to computers and computer accessories. During this period of time, computers have become almost as common in Canadian households as toasters, radios and televisions. More importantly, from a waste management perspective, computers and other electronic equipment and appliances have tended to become obsolete much faster than traditional household appliances, finding their way into the waste stream often a few short years after the original purchase.

Until recently, the focus of many waste management systems in Canada was on reducing the overall volume of solid waste through programs to divert the highest volume products from disposal toward reuse and

recycling. During this stage of the development of waste management in Canada, electronic waste generated limited interest because it still made up a relatively small percentage of the waste stream. With volumes increasing dramatically over the years, and a growing understanding of the environmental and human health risks associated with electronic waste, some jurisdictions have recently started to focus on the management of electronic waste. It is this effort that is assessed in this article, with a particular focus on three jurisdictions in Canada, Alberta, Ontario, and Nova Scotia. Given the stage of implementation, and the absence of much literature on this topic in Canada, this article is intended as a foundational piece. The fundamental question asked is whether the regulatory approaches implemented in Alberta and proposed in Ontario and Nova Scotia are likely to ensure effective collection, recovery and treatment of electronic waste so as to minimize the environmental impact considered on a lifecycle basis. As more jurisdictions in Canada move to implementation, it is hoped that future work can build on the groundwork provided here.

To this end, Part 1 briefly considers the evolution of waste management in Canada. This is followed in Part 2 by a brief assessment of the scope of the IT waste problem. Part 3 then considers the international law context for IT waste, with a focus on Canada's commitments regarding the international movement of IT waste. Part 4 outlines law and policy options to address the environmental problems associated with IT waste and its disposal in municipal landfills.

Part 5 then offers a comparison of the current and proposed approaches to IT waste management in Canada, with a focus on Alberta, Ontario and Nova Scotia. The approaches in these jurisdictions are assessed based on their effectiveness in four key areas: collection, treatment and recovery, financing, and the overall effectiveness in reducing the environmental impact of IT waste. The conclusion highlights key challenges of addressing electronic waste in Canada, reflects on current approaches, and offers some recommendations on how to move forward with an environmentally responsible approach to electronic waste in Canada.

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Waste Reduction in Canada²

Solid waste management in Canada has evolved in a number of stages. Stage one involved individuals looking after their own waste, through processes such as composting and burning. As the amount and composition of waste increased, and more and more of the population gravitated toward urban centers, traditional waste management methods were inadequate from aesthetic and health perspectives. Municipalities began to offer waste disposal services, generally paid out of municipal tax revenues. More recently, as volumes have continued to increase, and the composition of waste has become more and more complex and toxic, environmental and cost concerns have started to influence approaches to solid waste management.³ In the 1980s, many jurisdictions in Canada implemented recycling programs for beverage containers and paper products. In the early 1990s, a number of provinces accepted a target of reducing municipal waste by 50% compared to a 1988 base year by 2000.⁴ While this was not a binding target, it did motivate a number of jurisdictions to take further steps to divert waste from landfill disposal. Motivations ranged from difficulties in locating new landfills to the cost of managing and remediating existing ones. A number of provinces implemented organic collection programs and added certain plastics and other recyclable material to the list of material to be diverted from landfill disposal for reuse and recycling.⁵

The leadership in Canada in the 1980s came from provinces such as Ontario, where the first successful large scale blue box programs were implemented to divert beverage containers and paper products from the regular waste stream. In the 1990s, considerable leadership came from some of the smaller provinces, most notably Nova Scotia and Prince Edward Island. These were the first provinces to achieve the 50% waste reduction target.⁶ This was achieved mainly by achieving higher collection rates for material designated for recycling, and by going beyond recycling of standard material such as paper, plastics and metals to organic collection, construction and demolition waste, and other materials not previously covered.⁷

Recycling Efforts

One of the first responses to the increasing volume of municipal solid waste and resulting challenges of locating and operating landfills was to implement recycling programs to divert some of the most valuable material from the waste stream. Some jurisdictions initiated free, voluntary curbside collection programs, whereas others experimented with deposit programs with return to depots for refund. At the same time, most of the remaining programs relying on reusable instead of recyclable packaging disappeared. Most notable in this regard is the sharp reduction in the use of reusable beverage containers during the 1980s and 1990s. Recycling

programs were generally operated and funded by municipalities, with some support from industries that contributed to a particular waste stream and/or consumers through deposits. Common material recycled through these efforts included beverage containers, other plastic, metal and glass containers, paper and tires.⁸

Organic Waste Recovery

A key innovation in waste management programs in the last 1990s was the diversion of organic waste from landfills. Only a few provinces, most notably Nova Scotia and Prince Edward Island, made a serious effort to implement province wide programs to keep organic material out of the waste stream. Diverting organic material from the waste stream was critical for a number of reasons. It represented about one third of the waste stream. It was a valuable resource, with potential to enhance soil quality for agriculture, parks, and recreation facilities. Furthermore, organic material represents the main source of water in a capped landfill, without which landfills can be turned from sources of toxic leachate to dry storage facilities for waste.

Organic programs range from curbside collection with central composting to backyard composting, community composting, and methane production. Choices among these options are often driven by different needs in urban areas, the need for quality control depending on the end use of the product, and how the organic program fits with the overall waste management program in a given area. The coverage of these programs therefore ranges from voluntary leaf and yard waste collection once a year to complete bans of organic material from the regular waste stream with a combination of curbside collection and aggressive promotion of backyard composting.

Residual Waste, and the Role of IT Waste

With paper, plastics, metals, glass, tires, and organic material covered through fairly comprehensive waste diversion programs in the 1990s, a number of jurisdictions started to turn their attention to the residual waste to determine whether there were other opportunities to reduce the volume or toxicity of the waste going to landfills. Efforts were made in some jurisdictions to divert items such as paint and medical waste from the waste stream.⁹ At the same time, a number of provinces began to recognize that electronic waste was a source of waste that had not been addressed through most waste management programs implemented in the 1980s and 1990s. It became clear that this source of waste would continue to grow both in volume and toxicity. In response, some provinces began to turn their attention to electronic waste. The nature and scope of the problem this source of waste represents is explored in the next section.

Scope of the IT Waste Problem

Traditionally, electronic equipment in Canada, such as televisions, stereo equipment, and other appliances, was expensive, durable, and was not subject to significant technical innovation. This meant that products were kept for long periods of time, resulting in IT waste making up a very small percentage of the overall solid waste stream. This has changed significantly over the past two decades as a result of a number of key developments.

Perhaps the most significant development is that computers have become a common appliance in most households and businesses. In addition, computer technology has become a more and more common component of every day appliances. A further development has been the shift to cell phone technology, including blackberries, with technology evolving rapidly, again resulting in significant waste issues.

Computers consistently have been subject to significant technical innovation, resulting in them being considered obsolete within relatively short periods of time. This has resulted in a growing volume of waste being generated in the form of old computer components and accessories. The impact of technology innovation was captured in what is known as Moore's Law which refers to

(t)he observation made in 1965 by Gordon Moore, co-founder of Intel, that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future. In subsequent years, the pace slowed down a bit, but data density has doubled approximately every 18 months, and this is the current definition of Moore's Law, which Moore himself has blessed. Most experts, including Moore himself, expect Moore's Law to hold for at least another two decades.¹⁰

In addition to ongoing innovation leading to a short lifespan for many electronic goods, unique challenges involved in the management of electronic waste include the following: the significant role that design has played in the marketing of products, the great variety of raw materials found in electronic equipment, the high level of toxicity of a number of its components, the labour intensity of disassembling electronic equipment, and the great difference in labour costs between Canada and the countries where most new electronic equipment is produced and assembled. The problem is exacerbated by the fact that it is often cheaper to purchase new electronic equipment than either upgrades or repairs. As a result, electronic waste has become the fastest growing and one of the more toxic components of the municipal waste stream.¹¹

The next sections consider the scale and nature of the problem. Section (a) provides some basic statistical information on IT waste. The various environmental challenges associated with the generation of IT waste are then summarized in Section (b). Categories considered

include landfill space, toxicity, resource depletion, energy, and greenhouse gas (GHG) emissions.

IT Waste Statistics

According to a recent study conducted for the RRFB in Nova Scotia, the composition of IT waste in Nova Scotia is estimated to include the following in order of their contribution to the waste stream by weight: televisions (1,766 tons), monitors (1,032 tons), computers (766 tons), computer peripherals (667 tons), stereos (182 tons), telephones (53 tons), cell phones (11 tons), and rechargeable batteries (7 tons).¹² Currently, therefore, televisions and computer components are the biggest contributors to the waste stream.

In terms of number of units, batteries and phones rank much higher than computers and televisions, but due to their small size make up a significantly smaller part of the waste stream. The study breaks down the generation of IT waste from household and commercial use. Not surprisingly, commercial waste in the computer and phone sectors is more or less on par with household waste, but significantly lower for televisions and stereo equipment.¹³

The study projects a continuing growth of IT waste in Canada. The estimated growth in the next 5 years is in excess of 11 %. Contributing factors to the continuing increase of IT waste are population growth, economic growth, increasing market penetration of IT products, and continuing technology obsolescence.¹⁴

A number of key trends are identified to contribute to the generation of IT waste expected to be generated over the next 5 years. Computer technology is expected to continue to evolve at rates similar to historical trends of a doubling of processing speed every 2 years or less. Monitor technology has shifted from CRT to LCD technology, resulting in most old monitors being replaced. Peripheral devices are being integrated resulting in new products and discarding of old printers, scanners, etc. Cell phone technology continues to evolve toward lighter and smaller units, with new features constantly being integrated. Finally, phone technology is moving toward cordless phones, resulting in an increased use of batteries.¹⁵

The variety of IT products expected to be discarded contains a range of raw materials. In order of weight, IT waste in Nova Scotia for 2005 is expected to contain: ferrous metals (1,260 tons), glass (1,253 tons), plastics (1,053 tons), other metals, including aluminum and copper (645 tons). Other materials make up an additional 224 tons of waste.¹⁶

Environmental Risks

Environmental costs associated with electronic waste include the landfill space it occupies, its toxicity, the depletion of non-renewable resources it contains,

energy use, and greenhouse gas emissions. IT waste is taking up an increasing amount of landfill space.¹⁷ With many jurisdictions moving to second generation landfills with liners and leachate collection systems, the cost of providing landfill space is at a premium. With increasing challenges in locating landfills in light of local opposition and concern about their environmental and human health impact, prolonging the life of existing landfill facilities is crucial for municipalities in Canada.

A number of materials used in the manufacture of electronic equipment are either directly toxic or become toxic when they interact with other common materials found in many landfills, such as organic material. A significant risk of pollution from these toxic material results from the escape of leachate from landfill sites. The presence of various metals in electronic equipment is of particular concern in this regard.¹⁸ In addition, there are environmental impacts associated with the manufacturing process. Such impacts can include the release of toxic material in the form of air pollution and water based effluent. Finally, toxic components of electronic waste create challenges for transportation, whether for final disposal or for reprocessing.

The current approach to the manufacture and disposal of electronic equipment is linear as opposed to being a closed loop system. This means virgin material is generally used to manufacture the product, it is used until the equipment becomes obsolete, and the material is then disposed of in a manner that makes the materials unavailable for further use. As the manufacture of electronic equipment involves the use of a number of non-renewable resources, such a linear approach is clearly unsustainable by any measure. The main non-renewable resources involved are metals, glass, and fossil fuels.¹⁹ Closed loop systems that ensure the reuse or recycling of the raw materials used in electronic equipment reduce the depletion of these non-renewable resources.

Fossil fuels are used in the manufacture of electronic equipment for plastic components and as a source of energy in the manufacturing process. Energy consumption throughout the life cycle of electronic equipment is significant. It includes the manufacture, transportation, use, and disposal stages.²⁰ For purposes of considering waste management options after the equipment has become of no value to its original user, the energy use during manufacture and transportation to market are of particular interest. That energy use needs to be compared to the energy intensity of various waste management options, including disposal, reuse, and various recycling options. In most cases, disposal is the most energy intensive option, with recycling often somewhat less energy intensive, and reuse generally the least energy intensive waste management option. A life cycle analysis that includes the energy used in the waste management process can confirm the relative energy intensities of these three basic options.

Closely linked to the use of energy are GHG emissions associated with the manufacture of electronic equipment. Use of secondary material generally results in a significant reduction of GHG emissions compared to the use of virgin material.²¹ Reuse is generally recognized as the least GHG emission intensive waste management option. Actual emission comparisons are needed to be able to evaluate GHG emission implications of waste management options.

Clearly, there are a number of environmental costs associated with the disposal of electronic waste. All of this, points to the importance of a comprehensive analysis of the life cycle environmental cost of electronic products with a view to ensuring that they are designed to minimize the life cycle environmental cost, including the environmental cost associated with their management after use.

The International Context

Considering the range of human health and environmental risks associated with disposal, and the labour intensity of disassembly and recycling, it is not surprising that many developed countries started to look to less industrialized States for disposal of electronic waste as the volume of this waste increased in the 1980s and 1990s.²² In many cases, the environmental problems associated with the management and disposal of that waste were thereby exported to countries ill equipped to deal with them responsibly. In response, 116 nations signed the *Basel Convention on the Control of Transboundary Movements of Hazardous Waste and Their Disposal*.²³

The objectives of the Convention are quite broad. They include reducing the generation of hazardous waste, reducing its international movement, and ensuring that when such waste is transported internationally, it is managed in an environmentally responsible manner. The guiding principle of the Convention is that each country be accountable for its own hazardous waste. The objective may be broad; however, the actual measures included in the Convention to achieve these objectives are somewhat limited. The key measures imposed are procedural in nature, designed to ensure the importing country is fully aware of the nature of the material.²⁴

Members of the OECD have also adopted a number of council decisions dealing with the movement of hazardous waste. Most notably, for purposes of electronic waste, is Council Decision C(2001)107, dealing with simplified procedures to control the import and export of waste destined for recycling and recovery. As the OECD includes both member and non-member states of the Basel Convention, its decisions have generally been con-

sistent with but fallen short of obligations under the Convention.²⁵

Canada's international obligations under the Basel Convention, the OECD directives, and the bilateral agreement with the US have been implemented through regulations under the *Canadian Environmental Protection Act, 1999* [CEPA].²⁶ The hazardous waste regulations were amended in 2005 to incorporate the most recent decision of the OECD, to bring the movement of hazardous waste more fully under CEPA, and to ensure full compliance with the Basel Convention.²⁷ The regulations specifically identify electronic waste as hazardous waste. Treatment of hazardous waste differs depending on whether it is intended for disposal or recycling, with more streamlined procedures for waste destined for recycling.

In spite of these international efforts to date, the shipment of electronic waste to developing countries has become a growing problem, resulting in environmental damage and working conditions that would not be tolerated in the exporting countries. In recognition of the ineffectiveness of the Basel Convention at solving the hazardous waste dumping problem from developed to developing States, parties to the Convention negotiated an amendment for a complete ban of the export of Hazardous Waste to developing countries.²⁸ To date, this amendment has only been ratified by a few States.²⁹ Most notably, the United States has not ratified the Basel Convention or the amendment. Instead, it has worked with other developed States through the OECD, and has entered into a number of bilateral agreements, including one with Canada.³⁰

For purposes of this article, in assessing the effectiveness of domestic waste diversion programs, it is therefore critical to consider the life cycle implications of waste management options. This means looking beyond the diversion of the waste from local landfills to follow its path through disassembly, recovery, reuse of recovered material, and final disposal of residual waste. In theory, that does not mean the recovery process has to take place within Canada. Without adequate safeguards to ensure appropriate recycling in other countries, however, domestic measures to prevent the export, and to develop internal capacity to process electronic waste are critical elements of any successful electronic waste management program. For purposes of this article, the focus is therefore on domestic measures, assuming that the best way to control the life cycle impact of electronic waste is to keep it within Canada.

Possible Law and Policy Responses

A wide range of law and policy options have been implemented in jurisdictions around the globe to manage solid waste generally and IT waste particularly.³¹ The objectives of these measures range from a mini-

malist approach of covering the cost of disposal without changing the composition of waste, to end of life management or a life cycle approach to reducing IT waste.³² Options in the context of end of life management include encouraging end of life recycling and encouraging reuse in various forms.³³ A further step to a life cycle approach would involve encouraging changes in the manufacturing process to facilitate closed loop systems. In this section, some of the key law and policy options are briefly summarized.

There are a number of players in the electronic waste equation. They include:

- Producers (manufacturer and brand owner)
- Wholesalers, distributors
- Retailers
- Consumers
- Waste handlers
- Taxpayers

Any or all of these can potentially be held responsible for all or aspects of electronic waste management under a regulatory regime.³⁴ Each contributes to the problem, and each therefore has a potential role to play in addressing it. For example, producers collectively are responsible for raw material extraction, for the design of the equipment, for the manufacturing process and for its assembly. Responsibility for marketing is often shared between the producer, the wholesaler, and the retailer. Consumers in turn reward certain producers and retailers for the choices they make, in their purchasing decision as well as the basic choice to repair, upgrade or replace outdated or defective electronic equipment. Consumers also make choices about their participation in collection, recycling and reuse efforts offered by producers, retailers or governments.³⁵

Collection Options

Collection issues generally fall into two categories, the design of the collection process itself and the allocation of responsibility for its design, implementation, and costs. Historically, the responsibility to design, implement and pay for waste management programs has rested with taxpayers through a combination of municipal and provincial government programs. More recently, a number of waste diversion programs have encouraged and sometimes required the involvement of producers, retailers and consumers in the delivery and costs of the programs. Examples include, return to retail programs for beer bottles and tires in some jurisdictions, corporate-government funding arrangements for curbside recycling programs, and the establishment of depot systems funded either by producers or consumers.³⁶ The financing of collection is addressed below, under "Treatment and Recovery". The basic choice between municipal and producer collection is considered here.

Municipal Collection

Municipal collection is the dominant mode of collection of household waste in North America. Garbage destined for disposal at landfills has been collected through municipally run curbside collection programs for the past century in most jurisdictions. In the 1970s and 1980s, when waste diversion and recycling programs were first introduced, it was considered only natural to use existing curbside collection programs to encourage households to source separate and thereby divert the most valuable components of the waste stream for recycling. Today, many jurisdictions in Canada collect beverage containers, paper products, plastics, metals, and organic material separately through curbside collection programs to facilitate the diversion of valuable waste material from disposal in landfills.

Producer Collection

Producer collection of waste is a relatively recent development. It includes any collection system that is under the primary responsibility of the producer, wholesaler and retailer of the product. It can either involve return to retail or separate collection facilities offered by producers who are responsible for taking back any waste generated by the products they sell. The most notable and comprehensive example of this approach in the context of electronic waste is the EU's waste electrical and electronic equipment (WEEE) program.³⁷ This approach to allocating responsibility for the collection and management of waste was first introduced in Germany in 1991 with respect to packaging waste. It essentially held producers responsible for the packaging waste by requiring retailers to accept any packaging waste at the point of sale. Producers' responsibility for the products they sell has since been expanded in Germany specifically and the EU more generally beyond the packaging to the products themselves.³⁸ Extended producer responsibility can be government driven as in the case of WEEE, or it can be industry driven as in the case of Interface Inc. in the United States.³⁹

Treatment and Recovery

Treatment and recovery are often only indirectly addressed in the design and implementation of waste diversion programs. Starting with recycling programs in the 1980s for the recovery of paper, glass, plastics and metal waste, collection programs were often implemented through legislation and regulations, seemingly on the assumption that if you diverted these programs from the regular waste streams, markets would open up. Some jurisdictions went a step further to ban these materials from landfill disposal, thereby requiring waste collectors to find alternatives to disposal. A number implemented initiatives to encourage recycling industries to re-process the materials diverted. In many juris-

dictions, however, it is difficult to track the effectiveness of the waste management program beyond collection to re-processing.

The extent to which waste management programs focus on the treatment and recovery depend to some measure on the objective of the program. If the primary objective is to recover the cost of collection or to keep the material collected out of the local landfill, one may expect little attention being paid to the treatment and recovery process. If, however, the objective is to reprocess the materials used, to encourage producers to set up closed loop systems, to minimize the life cycle environmental impact of these products, an effective treatment and recovery strategy will be crucial to achieving this objective. In this context, volumes of waste expected, local processing capacity, and distance to markets for recycling and reprocessing will be critical.

Financing

With respect to the financial burden of diverting electronic waste from the regular waste stream and ensuring responsible treatment and recovery, the choice is among the taxpayer, the producer and the consumer of the product involved. What combination of allocation of the cost is most effective depends on the objective. Imposing the cost on taxpayers will reduce the cost of the product and increase opportunities for producers to profit from the sale of electronic goods. Imposing the cost on consumers may influence consumer choices. For example, having to pay for the disposal at the time of purchase may encourage consumers to upgrade or repair equipment rather than purchase new equipment and dispose of the old. Deposit refund systems can be used, in addition, to encourage proper disposal of the waste product. Finally, imposing the cost of managing the waste on producers can encourage changes in the design that may reduce the cost of managing the waste, and may encourage design that allows for more effective upgrade and repair.

The extent to which these allocations of the cost can influence the overall effectiveness of the waste management program depends on a great number of factors, such as the amount of the fee involved, the total population and population density of the jurisdiction considering the measure, and its ability to convince other jurisdictions to implement similar programs. Availability of alternatives is also crucial. For example, a deposit refund system can be effective, as long as the refund justifies the inconvenience of having to take the material to a depot. The deposit may encourage upgrading and repairs, if the deposit is high enough to offset the high labour cost of upgrades and repairs, and there is a sufficient incentive for producers to manufacture products that are suitable for upgrade and repairs.

Waste Minimization

A fundamental choice in the design of a waste management system for electronic waste is in the objective that drives the system. Is the objective to recover the cost of disposal, or to divert already valuable components of electronic equipment for recycling? Alternatively, is the objective to minimize waste by creating the necessary incentives to encourage an integrated approach to the life cycle of the product to minimize waste and environmental harm from the production, use, and disposal of the product? For purposes of this article, an integrated approach is proposed, leading to an evaluation of electronic waste management approaches on the basis of minimizing the life cycle cost, including environmental harm from production, use and recovery.⁴⁰

Canadian Experience with the Management of IT Waste to Date

As with most environmental issues in Canada, it is difficult to discuss law and policy options for addressing the management of electronic waste without considering the respective roles of the federal, provincial and municipal levels of government. Constitutionally, the provincial level clearly has jurisdiction over electronic waste under Section 92 of the *Constitution Act, 1867*.⁴¹ Federal jurisdiction, other than in relation to the inter-provincial and international movement of the waste, is more difficult to establish. Depending on the circumstances, potential areas of jurisdiction might include the criminal law power, trade and commerce, jurisdiction over taxation, and the federal spending power.

One would therefore expect the federal government to play a coordinating role, with perhaps some financial incentives through taxation and spending powers. In addition, the *Canadian Environmental Protection Act, 1999* provides the federal government with an opportunity to regulate the use and disposal of toxic material in electronic products.⁴² Subject to the issue of toxicity, the constitutional power to regulate in this area appears well settled.⁴³ Possible initiatives might include a phase out of certain materials as alternatives become available, financial incentives for environmental design, and national standards to require certain materials to be taken out of electronic products before disposal.

On the coordination side, the Canadian Council of Ministers of the Environment (CCME) did bring jurisdictions in Canada together to adopt a set of principles for electronic waste stewardship in 2004.⁴⁴ The Guide includes 12 principles for the proper management of electronic waste. Under these principles, responsibility for electronic waste is to rest primarily with producers, with the cost borne by producers and users rather than taxpayers. The principles furthermore focus on life cycle management, the “4 R” hierarchy, and deal with the

expected scope of electronic waste management systems.⁴⁵

In addition, the CCME has identified a list of products to be included in any regulatory regime and products that it feels should be considered for inclusion.⁴⁶ These two lists include not only what is commonly considered IT related equipment but encompass a full range of household devices. Those traditionally considered IT related are generally included in the first list, whereas other products that contain similar components but are not generally thought of as IT products are included in the “to be considered” category in the second list.

Other than the CCME initiatives to coordinate efforts nationally, responsibility for solid waste generally, and electronic waste more specifically, is generally recognized to rest with the provinces and municipalities. Municipalities are dependent for their jurisdiction on the delegation of power and responsibility from the provinces. The collection and disposal of domestic waste has generally been delegated to municipalities, without provinces relinquishing jurisdiction over waste management issues more generally. This leaves the provinces as the key level of government to respond to the electronic waste issue.

In fact, a number of provinces have started to look at electronic waste as a serious issue within their waste management systems. For purposes of this paper, three provincial initiatives are considered in some detail. Alberta is considered, because it was the first province to implement an electronic waste management program. Ontario's program was included in this study, because it is Canada's most populated province, and it chose a different approach than Alberta. Finally, Nova Scotia was selected because it has one of the more comprehensive and sophisticated provincial solid waste management programs in Canada.

Alberta

Alberta was the first Canadian province to implement an electronic waste management program. The government conducted a consultation process⁴⁷ to help it decide how to tackle the problem. The consultations consisted of workshops and surveys. The opinions gathered through these mechanisms were overwhelmingly in favour of the government taking action to deal with the problem of electronic waste but varied on the best approach to this. The divisions reflected the different possible approaches already noted (i.e. whether the burden should be placed on the producer, the retailer, or the consumer). Alberta has put in place regulations that pass the cost on to the consumer through a direct surcharge on devices. The amount of the surcharge depends on the device in question. When a device becomes “waste” it cannot be consigned to the usual garbage. Rather, Alberta has established a government

agency to handle this particular type of waste, the Alberta Recycling Management Authority (ARMA).

Alberta's program was initiated in 2004 under Part 9 of the Alberta *Environmental Protection and Enhancement Act*.⁴⁸ Part 9 of the Act provides for the designation of material by way of regulation, which imposes certain statutory obligations for any designated material,⁴⁹ and provides for additional measures to manage the collection, recycling, and disposal of designated material through further regulations.⁵⁰ Essentially, material so designated is to be subject to some level of waste management, with the detail to be worked out on a material by material basis. For example, Alberta had existing programs for beverage containers and tires, both of which had previously been designated under these provisions.

In May, 2004, two sets of regulations were passed by the Alberta government to implement its electronic waste management program. The first set defines certain electronic waste as designated material under the Act.⁵¹ The regulations cover the following material:

- Televisions
- Computers, computer equipment and monitors
- Audio and video equipment
- Telephones and fax machines
- Cell phones and other wireless devices
- Electronic game equipment⁵²

Also included in the regulations is a list of disposal surcharges to be paid at the point of purchase for any electronic equipment covered by these regulations. The fee ranges from \$5 for laptops, to \$45 for large screen televisions.⁵³

The second set of regulations passed provides for the management of the electronic waste designated. They assign two main responsibilities. Suppliers of designated material are required to charge and remit the advanced disposal surcharge to the Association established in these regulations. The Association is then required to set up an industry operated recycling fund for each designated material to pay for the management of designated waste material. The program is expected to include collection, transportation, storage, recycling, marketing, waste minimization, and education related to the management of the designated waste material.⁵⁴

Collection

Collection of electronic waste takes place through some 100 collection sites set up in the province. Not surprisingly, the sites are concentrated in urban areas. However, with the exception of extreme northern parts of the province, and the two urban centers, the coverage appears fairly even. No statistics were available on average distance traveled to the collection sites, making an assessment of the cost of collection and convenience to the consumer impossible. According to the ARMA web site, over 63,000 monitors, 60,000 computers,

33,500 printers and 30,000 televisions were recycled under this program in its first year of operation, between October 2004 and 2005. No statistics on the amount of electronic waste still found in the regular waste stream were available. However, in a recent article in *Canadian Business*, it was estimated that 190,000 televisions were destined to go to the landfill during the course of the next year. This would suggest a current recovery rate of about 16%.⁵⁵

It is also not clear whether efforts are being made to divert electronics that still end up in the regular waste stream to the collection sites or directly to one of the five processing facilities. Other critical issues left unresolved in the regulations are details on how the collection sites are funded, and exactly what their relationship is to the processing facilities and to the ARMA. The most important unanswered question, perhaps, is what safeguards are in place to ensure once these goods are delivered to a collection facility, that opportunities to recover, recycle and reprocess are maximized, and the risk of improper disposal or export is minimized.

Treatment and Recovery

There were five treatment and recovery facilities licensed to accept electronic waste material at the time of writing.⁵⁶ These facilities receive the collected waste products from the 100 collection sites set up in the province. The electronic waste products are then disassembled, sorted into components for resale, and further processed as appropriate. There were no statistics readily available on the amount of electronic waste recovered at these processing facilities. Detailed information on end products, markets, and revenues was also not readily available.

A full assessment of the effectiveness of the Alberta program would involve further research on exactly what is being produced, on the recovery rates, and the volume and composition of residual waste from the treatment and reprocessing process that still ends up in the waste stream. Essentially, what is missing to date is a life cycle analysis. One would have expected this to be done in a generic sense during the planning stage of the Alberta program to be followed up with an audit of the process from collection through treatment, reprocessing, resale and disposal based on the initial implementation phase.

Financing

The Alberta electronic waste management program is financed through the collection of advanced disposal fees collected at the point of retail. In other words, it is the consumer who pays for the management of electronic waste up front. The Alberta Recycling Management Authority is responsible for ensuring that members of the retail and manufacture supply chain collect and remit the appropriate fees. Members of the supply chain

include the manufacturer, distributor, wholesaler, and retailer, and are collectively referred to as the suppliers.

The Authority keeps a list of suppliers eligible to sell designated material and responsible for the collection of the surcharge.⁵⁷ Suppliers are required to register in order to be eligible to sell electronic products in Alberta, and are responsible for charging the appropriate fees. The funds are remitted to an Association which in turn makes the funds available to an industry run recycling council called Electronics Recycling Alberta Industry Council (ERAIC) set up specifically to oversee the electronic waste management system. It is ERAIC that then advises the Association on the best way to spend the funds collected to ensure the proper collection, recovery, and disposal of electronic waste.

Assessment

There is little indication that waste minimization is a priority within the Alberta program. There is reference to waste minimization in the regulations,⁵⁸ but the focus of the program is clearly on diverting electronic waste from the regular waste stream, and recycling as much of the waste as possible. The program is administratively simple, and to its credit was the first of its kind in Canada. Its drawbacks include its failure to fully implement the CCME principles, and the absence of an apparent effort to encourage reuse or producer responsibility. The program does not contribute to the effort in other jurisdictions to motivate manufacturers to design for reduced life cycle environmental impacts. There is a surprising absence of public information on collection, recovery, recycling and reprocessing rates. Compliance efforts appear focused on the disposal fee rather than on collection, and it remains to be seen what collection rates will be achieved through the collection facilities approach.

Ontario

Ontario is still in the early stages of implementing its electronic waste program. Similar to other provincial solid waste legislation, Ontario's *Waste Diversion Act, 2002*⁵⁹ provides for the designation of waste to be managed under the Act. Such a designation was made with respect to electronic waste by way of regulations passed under Section 42 of the Act in late 2004.⁶⁰ Under these regulations, there is a long list of items designated as waste electrical and electronic equipment (WEEE). Included are 49 household appliances, 28 computer related items, 24 telecommunications products, 22 categories of audio-visual equipment, 11 types of toys, 32 tools with electronic components, and 36 other instruments.

The designation of these items does not itself impose an obligation to implement a waste management program. It does, however, allow the Minister under Section 23 of the *Waste Diversion Act* to require Waste Diversion Ontario to develop a program for the

waste material so designated. Waste Diversion Ontario is a corporation specifically set up under the Act to develop, implement and operate waste diversion programs for designated waste.⁶¹ Its board consists of representatives of municipalities and various industries.⁶² Waste Diversion Ontario is, for example, responsible for the blue box program. The general concept is that Waste Diversion Ontario develops and implements waste diversion programs for designated waste in coordination with industry funding organizations (IFO), similar to the relationship between the Alberta Recycling Management Authority (ARMA) and the Electronics Recycling Alberta Industry Council (ERAIC) referred to above.

At the same time as the WEEE regulations were passed, the Minister directed Waste Diversion Ontario under Section 23 of the Act to develop a waste diversion program for waste designated under the WEEE regulations.⁶³ The letter identifies selected items under the categories of household appliances, computer related products, telecommunications equipment and audio-visual equipment as a priority, suggesting that the initial program may be limited to these items. The letter provides for the establishment of an IFO for electronic waste, sets out the composition of the board and deals with administrative matters such as voting rights. It provides overall direction to Waste Diversion Ontario on the general expectations for the program, including general adherence to the 12 CCME principles. It requires consideration of design for the environment, issues related to free riders, electronic waste generated before the implementation of the program, and a concern for the general effectiveness and efficiency of the program.

These issues were to be considered through a study to be commissioned by Waste Diversion Ontario to provide the basis for a final decision in 2006 on the nature and scope of Ontario's electronic waste diversion program. In response to this letter, a consultant study and a summary report to the Minister were released on July 8, 2005.⁶⁴ The study was overseen by a multi-stakeholder working group, with a composition similar to the IFO to be set up for the program. While the study does not identify a final design of the program, it does offer sufficient insight into the approach Ontario is likely to take to allow for a comparison to the programs in Alberta and Nova Scotia.

Collection

No specific collection method is identified in the various reports prepared to date on the Ontario electronic waste program. The consultant study commissioned by Waste Diversion Ontario does, however, outline collection mechanisms in use in Ontario for electronic waste. At the municipal level, the most common collection method is currently at the landfill and transfer stations. Recycling depots are common collection points for household appliances. Special collection events for computer equipment are used by some

municipalities. "Return to Retail" is the industry stewardship alternative offered for some products in some parts of the province. While some are free, others involve some cost to the consumer. Most notably, the study lists a partnership between the city of Ottawa and some 300 retailers for the return of about 60 electronic products.⁶⁵ Other take back programs are offered by HP, IBM, Office Depot, and some appliance retailers.⁶⁶

It would be reasonable to expect Ontario to rely primarily on the existing blue-box program for collection purposes. If this route is chosen, one would expect the main alternative to be return to retail programs. Such programs could be offered by stewards who chose to manage their own electronic waste rather than submit a fee to Waste Diversion Ontario. As discussed below under financing, one of the recommendations of the July 8, 2005 study submitted to the Minister is that stewards who manage waste from their own products should not be required to submit a fee.

Treatment and Recovery

There is limited discussion of treatment and recovery under the Ontario program. The consultant study does identify current processing infrastructure, which included close to 20 facilities by 2005. In contrast to Alberta, the Ontario study provides some information on the capacity of these facilities in terms of waste category and amount of waste each can process. The study also seeks to identify the re-usable products as well as residual waste resulting from these reprocessing efforts. Based on this work, the study offers some estimated collection and diversion rates for the four categories of electronic waste identified in the Minister's letter as a priority. For household appliances, the rates are high, a collection rate of 83% and a diversion rate of 62%. Both rates are based on an estimated tonnage of appliances discarded during 2004. Rates for the other three categories are much lower, in the range of 1-3% collection and up to 2% diversion. The study stops short of projecting markets or achievable diversion rates for the materials that can technically be recovered.

Financing

The two options considered for the financing of the electronic waste program in Ontario, are cost internalization by the producer and fees applied at the point of purchase. The study concluded that point of sale fees can only be implemented through regulatory changes, and that similarly, new regulations would be required to either require or prevent making fees visible to consumers. The IFO would be able to assess fees against designated stewards. Stewards are defined in the Minister's letter to be "persons who are the brand owners, assemblers, in case of non-branded equipment, and first importers of products".⁶⁷ There was disagreement on whether the fees should be visible.⁶⁸

Another issue raised was whether fees should be variable based on the end of life management cost of the waste or alternatively based on the life cycle environmental cost of the product. A similar question was raised in the report about fees for historic waste. The report does not resolve the question, but does suggest that some of the reasons for applying variable fees, such as encouraging producers to design for lower environmental impact, may not be convincing in the case of waste generated before the implementation of the program. A related issue brought forward in the study is that the use of fees as a mechanism to encourage environmental design will only be effective if the fees are not easily passed on to the consumer. The extent to which fees, if collected from the stewards, would likely be internalized or passed on to consumers is therefore considered for a variety of products covered.⁶⁹ It remains to be seen whether internalization of disposal and reprocessing costs alone will encourage changes in design, or whether more direct action will be needed.

In the end, in spite of some clear differences among the working group members, the study does make a number of recommendations on how to fund the program.⁷⁰ First, it recommends that no fees be charged for historical and future products that are managed directly by stewards. Presumably this fee exemption would apply to stewards offering return to retail, and would be limited to products actually so returned, as opposed to any sold with a return to retail offer from the steward. In other words, care will have to be taken that the fee exemption only applies to successful return to retail efforts. One way to achieve this would be to still charge the fee on new products sold, but offer a rebate for each unit returned. If the costs are internalized by the steward, it would have to submit the fee for each unit sold that is not offset by a unit collected through the steward's collection program.

Furthermore, the study recommends fixed fees for some historical waste. It is not clear what, if any, categories of historical waste may have a variable fee assessed. For future waste, variable fees based on end of life management cost are favoured for most product categories. Again, the study does not specify what the exceptions might be. Finally, the program management costs are to be allocated based on return rates for historical waste if feasible. For future waste, the recommendation is to allocate fees based on current market share.

Assessment

Ontario has clearly endorsed the CCME principles, based on the Minister's instructions for the design of Ontario's program. The differential fees proposed and the acceptance of the end of life management cost should provide an important signal and incentive to encourage design for the environment. Given the relative

size of Ontario, this is a critical signal, and should encourage other provinces to follow suit. Beyond this, it is too early to evaluate Ontario's approach. Key outcomes to watch will be the collection process, and the effort the province puts into treatment, reprocessing and marketing of the recovered materials. Periodic analysis will be needed to fine tune the program and ensure that the life cycle environmental costs are minimized.

Nova Scotia

The Nova Scotia program is at the draft regulation stage.⁷¹ It is expected to be implemented sometime during 2006 by way of amendments to the existing solid waste-resource management regulations. The program is modeled on the existing paint recovery program. The draft regulations impose key obligations for the implementation of the program on brand owners and retailers of electronic equipment. Brand owners are defined to include the various parties involved in the supply chain up to, but not including, the retailer; the person who merely offers for sale the manufactured, assembled product. It is not clear from the wording of the draft regulations whether local assemblers of computers using prefabricated components would be considered brand owners or retailers under the regulations. Based on submissions made by the Canadian Federation of Independent Business, it would appear that assemblers are treated as brand owners.⁷²

Electronic products are defined through a list included as a Schedule to the regulations. Included are televisions, computers and common computer peripherals and accessories, as well as audio and video equipment, telephones, fax machines, cell phones, other wireless devices, and electronic game equipment. The list of included products is significantly longer than in Alberta, but not nearly as detailed or long as the list of products proposed for inclusion in the Ontario programme. Most significantly, Nova Scotia does not propose to include household appliances.⁷³

The focus of the draft regulation is on brand owners rather than retailers. Brand owners would be required to register with the RRFB, and either implement their own stewardship program approved by the Minister, or enter into an agreement with the RRFB to participate in a stewardship program implemented by the RRFB. Brand owners are expected to participate in a stewardship program, and must ensure that it includes an education and awareness program, must internalize the cost of the program, and are expected to maximize the reduction, reuse or recycling of electronic waste. Specifically, at least 80% of the reusable and recyclable portion of the electronic waste collected is to be recycled or reused. Finally, brand owners are expected to implement a "design for the environment" program to eliminate harmful materials, and redesign products for improved reuse, disassembly, and recycling.⁷⁴

Collection

Similar to Ontario, the Nova Scotia approach would offer a choice to the industry, either fund the collection system established by the RRFB, or ensure that your products are collected through your own collection system, most likely a return to retail program. It is not clear from the draft regulations whether brand owners will pay a fee per unit sold regardless of whether they implement their own collections system, and then recover a fee for each unit collected. The alternative would be for brand owners who implement their own collection system to be exempt from the fee. This will depend on what conditions the Minister imposes for authorization of an industry stewardship program proposed by a brand owner.⁷⁵ One important requirement built into the draft regulation is that any collection facility set up by a brand owner must accept all material designated as electronic waste in Nova Scotia, not just that brand owner's products.⁷⁶

In the end, it is reasonable to expect that the existing enviro-depots already set up across the province for the collection of beverage containers, paint, and other recyclable products, will be the main collection mechanism for electronic waste. Some brand owners may choose to implement their own programs, however, a few factors work against this option. First, the experience of the paint program shows that the Minister and the RRFB are likely to favour one program over a mixture of programs. Secondly, smaller brand owners, such as local assemblers, are likely to be intimidated by the prospect of having to negotiate an agreement with the Minister, and are therefore likely to prefer to pay a fee to the RRFB and promote collection at the depots. Space concerns, and the fact that brand owners with their own collection sites will have to accept all electronic waste, will also work against return to retail programs.

Another option not addressed is the use of municipally run recycling collection programs in Nova Scotia. One would expect such programs, given their convenience, to result in higher return rates than equivalent programs that involve return to special collection sites. Ideally, the two options would be used to complement each other, as is the case for beverage containers in Nova Scotia. To make this work, a return to depot incentive is used for beverage containers, a return of half of the deposit on the container, if returned to the depot. Residents therefore have the choice of convenience or financial reward. This option is not included in the current draft regulations for electronic waste, leaving limited motivation for Nova Scotians to participate in the program. Given the approach to paint, and the current form of the draft regulations, it is unlikely that collection through curbside programs will be offered to complement the depot system or return to retail.

Unfortunately, the relative inconvenience of the depot system compared to curb side collection, in combination with the absence of any financial incentive, will likely mean lower return rates.⁷⁷ On the other hand, the fact that these products are to be formally banned from landfill disposal, the well established recycling infrastructure, and the existing recycling culture in Nova Scotia, should all favour relatively high collection rates.

Treatment and Recovery

The treatment and recovery of designated electronic waste is only indirectly addressed in the draft regulations. The regulations impose requirements on brand owners to ensure that opportunities to reuse and recycle are maximized. Any brand owner that decides to operate a return collection facility has to ensure that at least 80% of material collected is either reused or recycled. The regulation does not address specifically where and how the materials collected will be reused or recycled.

The Electronic Waste Recovery Study prepared by PHA Consulting for the RRFB in 2004 does provide some insights into treatment and recovery options.⁷⁸ The report generally outlines the options for reuse with or without refurbishing the equipment on the one hand, and the disassembly of equipment for the purpose of reprocessing raw material on the other. Any product that cannot be re-processed is then disposed of either at a landfill, or by way of incineration. It appears to have carefully considered opportunities for reuse of individual components, as well as markets for various raw materials that are commonly found in electronic products.

The study identifies electronic processing companies by province. There are no companies listed for Nova Scotia with respect to computers, monitors and peripheral devices. No processing capacity exists in Prince Edward Island, and there are one and two respectively in Newfoundland and New Brunswick. The bulk of the capacity in Canada appears to be in British Columbia and Ontario.⁷⁹ The study also assessed the market for key materials, including various metals found in electronic equipment, glass, and plastics. It is clear from the study that the regional capacity to process electronic waste is currently very limited. Similar to other material diverted from landfill disposal, such as tires, plastics, and paint, the RRFB will undoubtedly be tasked with developing processing capacity and markets to ensure that the recycling targets set in the draft regulations can be met.

Financing

Financing of the Nova Scotia electronic waste management system is expected to be through a fee collected from the brand owners for each unit sold. The preferred approach based on the draft regulation and accompanying report is to require the brand owner to either internalize the cost, or pass it on as part of the cost of the product. Brand owners and retailers are not permitted to show the fee as a separate item at the point of retail.⁸⁰

Details on the fees to be charged are not set out in the draft regulations, however, based on an article by the architect of the program in Solid Waste & Recycling, a fee in the range of \$30.00 per computer system appears to be contemplated. The exact fee is likely to be left to the RRFB to negotiate with brand owners. There is no indication that differential fees, such as those proposed in Ontario, are contemplated in Nova Scotia; however, this would be within the powers of the RRFB to implement.

Assessment

On the positive side, it is very encouraging that a small province such as Nova Scotia appears poised to take steps to encourage and reward environmental design. The endorsement of the CCME principles is an important signal, as it preserves the hope for some level of national consistency and a reasonable standard for electronic waste management programs in Canada. The focus on internalization of costs has the advantage of encouraging producers, wholesalers and retailers to do what they can to reduce the life cycle impact of their products. This is limited, however, by the failure to adopt the differential fee approach considered in Ontario. Other areas to watch, will be, the collection rate that can be achieved through the Enviro-Depot system, and the related question of whether there has been sufficient focus on encouraging consumers to participate in the collection effort. It is unfortunate, in this regard, that the Nova Scotia approach does not appear to contemplate curbside collection, appears to discourage return to retail, and, at the same time, does not offer any financial incentive to consumers for returning electronic waste to Enviro Depots. These factors will likely limit participation mainly to Nova Scotians who already make use of the depots for existing waste diversion programs.

Conclusion

There has been considerable progress with respect to the management of electronic waste in Canada. Nationally, the CCME guidelines provide at least some hope for consistency and a race to the top rather than to the bottom. Provincially, Alberta, while first in time, has clearly not gone far enough to lead the way on the management of electronic waste. It is not clear that the collection system will ensure high recovery rates. More importantly, there is little indication that the approach will do much more than internalize the cost of disposal. More encouraging are the approaches proposed for Ontario and Nova Scotia. While yet to be implemented in either province, they offer the promise of moving beyond cost recovery to an overall reduction in the life cycle environmental impact of the products they cover. The implementation of Ontario's program will be particularly critical because of its large population and significant market share.

At the federal level, more effective controls over the export and import of electronic waste would be desirable, holding to the principle in the Basel Convention that each party be responsible for its own waste. In addition, CEPA clearly provides an opportunity to regulate the disposal of toxic components of electronic waste, thereby motivating municipalities to implement comprehensive collection and diversion programs while encouraging producers to eliminate the more toxic components from products they sell. Finally, if extended producer responsibility (EPR) does not motivate manufacturers to design for minimal lifecycle environmental impact, some action at the federal level may be required to ensure environmental factors are taken into account in the design of products.

At the provincial level, assuming the proposals put forward in Ontario and Nova Scotia get implemented, considerable progress is imminent. Still, it will be crucial to track collection rates, and to consider changes as nec-

essary to ensure rates at least comparable to diversion rates for more mature programs. Changes should consider a combination of making collection more user friendly, and providing financial incentives for consumers to make use of collection options. Careful attention will also have to be paid to dismantling and re-processing capacity. In smaller provinces, the focus would reasonably be on the dismantling process. Markets for the materials recovered will likely have to be found elsewhere. In more densely populated provinces, such as Ontario, it will be critical to ensure as much of the recovered material re-enters the manufacturing process, either in the electronic sector or elsewhere. Finally, regional, national and global cooperation will be needed to further motivate all players to play their part in reducing the life cycle environmental cost of electronic equipment. This will become even more critical as electronics appear to be poised to become more and more dominant in our lives.⁸¹

Notes:

¹ This waste is interchangeably referred to in this article as electronic waste and IT waste.

² See Virginia W. Maclaren, "Waste Management: Integrated Approaches" in Bruce Mitchell, ed., *Resource and Environmental Management in Canada* (Don Mills, Ont.: Oxford University Press, 2004) 371.

³ *Ibid.* at 374.

⁴ See, for example, *Environment Act*, S.N.S. 1994-95, c. 1, s. 93(1).

⁵ See Maclaren, *supra* note 2 at 383.

⁶ There is some uncertainty over the exact diversion rate, much of which can be explained by what is included in the numbers. The Statistics Canada rate for Nova Scotia, for example, for residential waste is at 28%, whereas the provinces' numbers have it at 50% waste diversion. According to provincial officials, the key difference is that the Statistics Canada rate does not include waste that is no longer managed by the waste management sector, making the provincial number more meaningful. See Maclaren, *supra* note 2 at 383.

⁷ See *Solid Waste-Resource Management Regulations*, N.S. Reg. 25/96, as am. by N.S. Reg. 24/2002 [*Solid Waste Regs.*].

⁸ *Ibid.*, Sch. B for a list of material covered in the NS recycling program.

⁹ See *Solid Waste Regs.*, *supra* note 7, ss. 18B-18L.

¹⁰ Webopedia, s.v. "Moore's Law", online: <http://www.webopedia.com/TERM/M/Moores_Law.html>.

¹¹ See Betsy M. Billingham, "E-Waste: A Comparative Analysis of Current and Contemplated Management Efforts by the European Union and the United States" (2005) 16 *Colo. J. Int'l. Envtl. L. & Poly* 399 at 404.

¹² Resource Recovery Fund Board, *Electronic Waste Recovery Study; First Interim Report: Establishing the Baseline* (1 October 2004), Table 2, at 2-4 [RRFB].

¹³ *Ibid.*, Tables 1 to 5, at 2-3 to 2-10.

¹⁴ *Ibid.* at 2-9.

¹⁵ *Ibid.* at 2-11.

¹⁶ *Ibid.*, Table 5, at 2-10.

¹⁷ *Ibid.* at 3-1.

¹⁸ *Ibid.* at 3-1.

¹⁹ *Ibid.*, Table 5, at 2-10.

²⁰ *Ibid.* at 3-1.

²¹ *Ibid.* at 3-1.

²² For a more detailed discussion of the problem of hazardous waste export to developing countries, see Jason L. Gudofsky, "Transboundary Shipments of Hazardous Waste for Recycling and Recovery Operations" (1998) 34 *Stan. J. Int'l L.* 219; Catherine K. Lin, Linan Yan & Andrew N.

Davis, "Globalization, Extended Producer Responsibility and the Problem of Discarded Computers in China: An Exploratory Proposal for Environmental Protection" (2002) 14 *Geo. Int'l Envtl. L. Rev.* 525.

²³ UN Doc. UNEP/IG.80/3, 28 *ILM* 657 (1989).

²⁴ Billingham, *supra* note 11 at 401, 406 – 409.

²⁵ See OECD, *Decision of the Council concerning the Control of Transboundary Movements of Wastes Destined for Recovery Operations*, C(92)39/Final; OECD, *Decision of the Council concerning the Control of Transboundary Movements of Wastes Destined for Recovery Operations*, C(2001)107/Final (Revision of Decision C(92)39/Final). For a copy of the consolidated decision see online: OECD <[http://appli1.oecd.org/olis/2001doc.nsf/linkto/c\(2001\)107final](http://appli1.oecd.org/olis/2001doc.nsf/linkto/c(2001)107final)>.

²⁶ S.C. 1999, c. 33.

²⁷ See Meinhard Doelle, *Canadian Environmental Protection Act & Commentary* (Markham, Ont.: LexisNexis Butterworths, 2005) at 38.

²⁸ See James T. O'Reilly & Lorre Barbara Cuzze, "Trash or Treasure? Industrial Recycling and International Barriers to the Movement of Hazardous Wastes" (1997) 22 *J. Corp. L.* 507 at 519-520.

²⁹ See Billingham, *supra* note 11 at 407-408. For the text of the amendment adopted at the Third Meeting of the Conference of the Parties at Geneva, see, *Amendment to Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal*, UN Doc. UNEP/CHW.3/35 (1995).

³⁰ See *Agreement Concerning the Transboundary Movement of Hazardous Waste*, Canada and United States, 28 October 1986, Can T.S. 1986 No. 39, T.I.A.S. No. 11,099. See also, O'Reilly & Cuzze, *supra* note 28 at 521-522.

³¹ Of particular interest in the electronic waste context, as alternatives to the traditional municipally run curb side collection programs, are initiatives in the EU and California. See, for example, Holly K. Towle, Andrew H. Dyer & Michael W. Evans "The European Union Directive on Waste Electrical and Electronic Equipment: A Study in Trans-Atlantic Zealotry" (2004) 31 *Rutgers Computer & Tech L.J.* 49; Jennifer L. Fordyce, "Out with the Old, In with the New – California Addresses the Growing Problem of E-Waste" (2004) 35 *McGeorge L. Rev.* 529.

³² The most advanced electronic waste program in this regard is generally considered to be the European WEEE directive. See EC, *Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on Waste Electrical and Electronic Equipment (WEEE)*, [2003] O.J.L. 037/24 [*The WEEE Directive*].

³³ Reuse is classified as either direct or indirect. See RRFB, *supra* note 12 at 3-22, 3-24, and Figure 3 at 3-25.

³⁴ See also RRFB, *supra* note 12 at 3-2, and Figure 1, for a discussion of players and the key functions they perform.

- ³⁵ For a general discussion of producer responsibility in the context of packaging waste, see A. John Sinclair, "Assuming Responsibility for Packaging and Packaging Waste" (2000) 12 *Electronic Green Journal*, online: *Electronic Green Journal* <<http://egj.lib.uidaho.edu/>>. See also A. John Sinclair & Lisa Quinn, "Policy Challenges to Implementing Extended Producer Responsibility for Packaging" (2006) 49:1 *Canadian Public Administration* 60.
- ³⁶ See RRFB, *supra* note 12 at 3.3 3.6.
- ³⁷ For a more detailed discussion on how the EU's WEE program implements the concept of extended producer responsibility for electronic waste, see Nicole C. Kibert, "Extended Producer Responsibility: A Tool for Achieving Sustainable Development" (2004) 19 *J. Land Use & Envtl. L.* 503.
- ³⁸ *Ibid.* at 511-514. In addition to a right to return waste to retail, EU waste management programs such as the WEEE program have imposed obligations on producers to alter the design of their products to reduce environmental impacts. These aspects of extended producer responsibility initiatives are addressed below.
- ³⁹ *Ibid.* at 518. In this case, a carpet company decided to take back old carpet to use as raw material in its manufacturing process.
- ⁴⁰ See Megan Short, "Taking Back the Trash: Comparing European Extended Producer Responsibility and Take-Back Liability to U.S. Environmental Policy and Attitudes" (2004) 37 *Vand. J. Transnat'l L.* 1217 at 1220-1226. See also Kibert, *supra* note 37 at 514.
- ⁴¹ *Constitution Act, 1867*, (U.K.), 30 & 31 *Vict.*, c.3, reprinted in *R.S.C.* 1985, App. II, No. 5.
- ⁴² For a description of the process of identifying and regulating toxic substances under *CEPA*, see also Doelle, *supra* note 27 at 14.
- ⁴³ See *R v. Hydro Quebec*, [1997] *S.C.J.* No. 76, 3 *S.C.R.* 213.
- ⁴⁴ See "Waste Management", online: CCME <<http://www.ccme.ca/initiatives/waste.html#ewaste>>.
- ⁴⁵ See "Canada-Wide Principles for Electronics Product Stewardship" (2004), online: CCME <http://www.ccme.ca/assets/pdf/eps_principles_e.pdf>.
- ⁴⁶ See "Canada-Wide Principles for Electronics Product Stewardship: Recommended E-Waste Products" (2005) online: CCME <http://www.ccme.ca/assets/pdf/eps_preamble_prdlst_e.pdf>.
- ⁴⁷ See online: Government of Alberta <<http://www3.gov.ab.ca/env/waste/waste/consultation.html>>.
- ⁴⁸ *R.S.A.* 2000, c. E 12, ss. 168-193.
- ⁴⁹ *Ibid.*, ss. 170 – 174.
- ⁵⁰ *Ibid.*, s. 175.
- ⁵¹ *Electronics Designation Regulation*, *Alta. Reg.* 94/2004.
- ⁵² *Ibid.*, s. 1(d).
- ⁵³ *Ibid.*, s. 3.
- ⁵⁴ *Designated Material Recycling and Management Regulation*, *Alta. Reg.* 93/2004, s. 6(1) [*Reg. DMRM*].
- ⁵⁵ See David Menzies, "Talking Trash" *Canadian Business* 78:11 (23 May to 5 June 2005) 27 at 27.
- ⁵⁶ See Electronics Recycling Alberta, "Registered Processors to Date", online: Alberta Recycling Management Authority <<http://www.albertarecycling.ca/public/data/documents/RegisteredProcessorInformation2pdf.pdf>>.
- ⁵⁷ See Electronics Recycling Alberta, "Eligible Electronics Suppliers Registered with Electronics Recycling Alberta (ERA), A Division of the Alberta Recycling Management Authority (ARMA)", online: Alberta Recycling Management Authority <<http://www.albertarecycling.ca/public/data/documents/RegisteredSuppliers110305pdf.pdf>>.
- ⁵⁸ *Reg. DMRM*, *supra* note 54, s. 6(1)(a).
- ⁵⁹ *S.O.* 2002, c. 6 [*WDA*].
- ⁶⁰ *Waste Electrical and Electronic Equipment*, *O. Reg.* 393/04.
- ⁶¹ *WDA*, *supra* note 59, s. 5.
- ⁶² *WDA*, *supra* note 59, s. 4.
- ⁶³ See online: Waste Diversion Ontario <<http://www.wdo.ca/content/?path=page80+item38689>>.
- ⁶⁴ For a copy of the consultant study, *Waste Electronic and Electrical Equipment Study* (2005) [*Consultant Study*], prepared for Waste Diversion Ontario and of the cover report, *Waste Electronic and Electrical Equipment Study* (2005) [*Cover Report*] prepared for the Minister, see "WEEE Study", online: Waste Diversion Ontario <<http://www.wdo.ca/content/?path=page80+item63446>>.
- ⁶⁵ See online: Ottawa <http://www.ottawa.ca/gc/takeitback/index_en.shtml>.
- ⁶⁶ See *Consultant Study*, *supra* note 64 at 100-103.
- ⁶⁷ See the Minister's letter to the Chair of Waste Diversion Ontario, dated 20 December 2004, at 5, online: Waste Diversion Ontario <<http://web-services.siriusweblabs.com/dotconnector/files/domain4116/letter122004.pdf>>.
- ⁶⁸ See *Cover Report*, *supra* note 64 at 4 5.
- ⁶⁹ *Cover Report*, *supra* note 64 at 4.
- ⁷⁰ *Cover Report*, *supra* note 64 at 15.
- ⁷¹ For a copy of the draft regulations see *Proposed Amendments to the Solid-Waste Resource Management Regulations made under Section 102 of the Environment Act*, online: Nova Scotia Environment and Labour <<http://www.gov.ns.ca/enla/waste/docs/SolidWasteRegsAmmend.pdf>> [*Draft Regulations*].
- ⁷² Canadian Federation of Independent Business, "Electronic Waste: Heavy-handed regulation will hurt small business" (April 2005). This submission on the draft regulations is available upon request at the Nova Scotia Department of Environment and Labour or online: Canadian Federation of Independent Business <<http://www.cfib.ca/legis/novascot/pdf/6124.pdf>>.
- ⁷³ See *Draft Regulations*, *supra* note 71, Sch. E. Based on discussions with provincial officials, it appears that NS is looking at implementing the program in phases.
- ⁷⁴ See the following proposed sections: *Draft Regulations*, *supra* note 71, ss. 18L-O.
- ⁷⁵ *Draft Regulations*, *supra* note 71, s. 18M.
- ⁷⁶ *Draft Regulations*, *supra* note 71, s. 18P. Based on discussions with provincial officials, it appears that this requirement may be changed before the regulation is finalized, eliminating the requirement for brand owners to collect all equipment at their own collection facilities.
- ⁷⁷ Nova Scotians pay ten cents per beverage container purchased, and get five cents back for each container returned to an enviro-depot. This has resulted in a very high return rate for beverage containers in Nova Scotia. The draft regulations do not contemplate any refund for the return of electronic waste, making similar return rates unlikely.
- ⁷⁸ See RRFB, *supra* note 12, Figure 2, at 3-23.
- ⁷⁹ See RRFB, *supra* note 12, table 11, at 3-32.
- ⁸⁰ See *Draft Regulations*, *supra* note 71, s. 18N(1)(c).
- ⁸¹ For further discussion of these issues, see Steven P. Reynolds, "The German Recycling Experiment and its Lessons for United States Policy" (1995) 6 *Vill. Envtl. L.J.* 43 at 72; Billinghurst, *supra* note 11 at 403.