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Algonquin Power Energy From Waste Facility

Environmental Controls | Facility Operations | Tipping Floor | Two Stage Incinerators | Air Pollution Control | Ash Removal | Ash Used in Asphalt - Magazine Article

What is an Energy from Waste (EFW) Facility?

An EFW facility incinerates non-hazardous solid waste for the purpose of producing energy. This facility has been open since 1992. Algonquin Power Systems Inc. operates the EFW facility in Brampton. Of the 174,000 tonnes of solid waste being processed each year, approximately 160,000 tonnes is residential waste from the Region of Peel. The remainder of the waste processed at the facility is international airport waste and industrial, commercial and institutional (IC&I) waste.

Environmental Controls

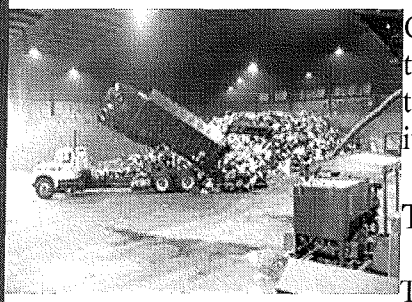
Stack emissions are continuously monitored and results are submitted to the Ministry of Environment (MOE) on a monthly basis. The Region of Peel also contracts an independent consultant to conduct stack testing on the facility. Emission results are discussed at Public Liaison Committee meetings held by the Region of Peel approximately every two months. The Liaison Committee also acts as a public forum, where public concerns are addressed.

Facility Operations

There are three sections of the EFW facility:

- Tipping Floor
- Two-Stage Incinerators
- Air Pollution Control (APC) System with Selective Catalytic Reduction (SCR)

Tipping Floor



Collection trucks deliver waste to the facility and unload it onto the tipping floor. The tipping floor acts as a buffer or storage area for the waste prior to being loaded into the incinerator. Here, large items such as mattresses and bicycles are removed

Two-Stage Incinerators

The waste is loaded into the five two-stage incinerators from the tipping floor by a front-end loader. Transfer rams feed the primary chamber of the incinerators where the waste is combusted in a controlled air environment (first stage). Off gases are moved into a second chamber where they are combusted in an oxygen-rich environment (second stage). The heat generated in the second stage is fed into a heat recovery boiler creating steam used to run a turbine and generate electricity. The ash remaining from the incineration process in the first stage (bottom ash) is moved into a quench tank to cool. It takes approximately five hours to burn the processed waste from the time the waste is loaded into the primary chamber until the bottom ash is discharged from the quench tank.

Air Pollution Control (APC)

The APC system includes: a wet-spray humidifier to cool and humidify flue gases; a venturi dry lime injection tower to remove acidic gases; a powdered activated carbon (PAC) injection system to reduce mercury; a baghouse filtering system to remove particulate and a selective catalytic reduction (SCR) reactor to reduce the Nitrous Oxides (NOx) emissions, dioxins and furans. This state-of-the-art APC system ensures that emissions from the facility are well below provincial air emission standards.

Ash Removal and Disposal

Fly ash collected from the baghouse filtering system is hazardous, and is disposed of at a secure hazardous waste landfill site. The bottom ash generated is processed to remove ferrous material and then screened into two size groups. The majority of the processed bottom ash is less than one inch in diameter and is currently being used as landfill daily cover. Research into beneficial end use applications and markets for the processed bottom ash is on-going. Potential applications include asphalt, brick and concrete manufacturing using processed bottom ash as a substitute for traditional granular material.

Questions? E-mail or call Public Works at the Region of Peel

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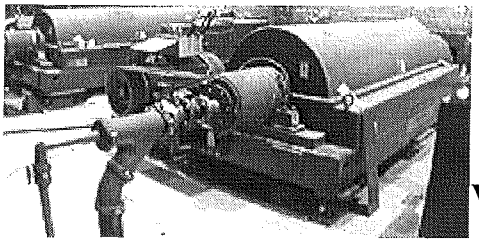


Wastewater

- Wastewater Treatment
- For Industry
- For Homeowners
- For the Community

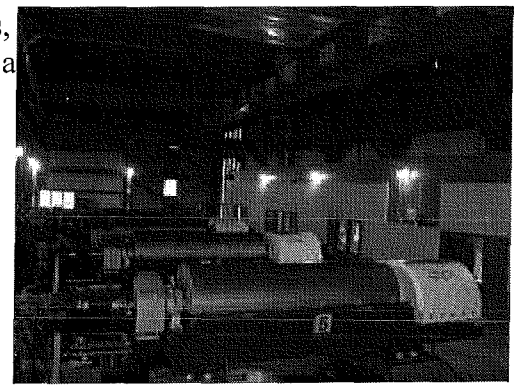
Diagram of Wastewater Treatment Process
(PDF 1 page, 399 KB)

- Conventional Wastewater Treatment
- Lakeview WWTF Home Page

Solids handling at the Lakeview WWTF consists of thickening, dewatering, incineration and ash storage in onsite lagoons.

Thickening Process:

Thickening increases the solids content of the sludge in preparation for dewatering. Waste Activated Sludge (WAS) is collected in WAS tanks and pumped to thickening centrifuges, which separate the liquid content of the sludge in a similar way to how the spin cycle of a washing machine removes water from clothes. Thickened WAS (TWAS) flows by gravity to blend tanks, where it is mixed with the raw sludge from primary treatment tanks. Centrate (the liquid removed from thickened sludge) is recycled back to the primary tanks. Polymer may be added to further thicken the sludge.



Top

Dewatering Process:

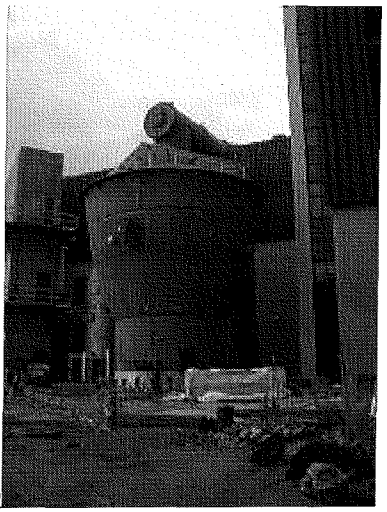
Dewatering increases the sludge's solids content to about 28 per cent total solids in preparation for incineration. TWAS and primary sludge are collected in the blend tanks and pumped to dewatering centrifuges. Dewatered cake is conveyed by an inclined screw conveyor into collection silos. Centrate flows by gravity to centrate tanks and is pumped

back to the head of the plant for treatment. Polymer is added to the blended sludge feed to increase efficiency.

Fluid Bed Incinerators:

The dewatered solids are pumped from the collection silos to the fluid bed incinerators. Dewatered cake is received by truck from Clarkson WWTF.

Combustion air is fed into the windbox at the base of the incinerator. Dewatered cake and supplementary fuel (fuel oil or natural gas), if necessary, is pumped into the fluidized sand bed. Water is evaporated and most of the solids combustion is processed within the sand bed. Final combustion occurs above the bed in the freeboard section with exhaust gases exiting at 700 - 900 degrees Celsius.



No supplementary fuel is needed if the dewatered solids are about 28 per cent.

(Above photo: Image shows incinerator under construction)

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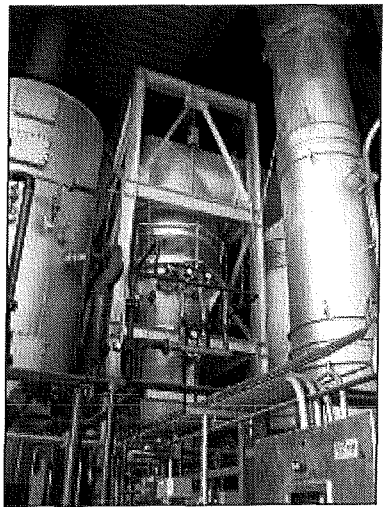
Air Pollution Control:

The air pollution control system consists of a quenching unit, impingement scrubber and a multiple, fixed venturi scrubber. The quenching unit reduces the exhaust gas temperature and most of the ash and gaseous pollutants are collected in a slurry and flow by gravity to the ash tanks. The impingement scrubber and fixed venturi further reduce the temperature of the exhaust gas and remove the rest of the ash and gaseous pollutants. Cleaned and cooled exhaust is discharged to the atmosphere. Dedicated emissions monitoring systems provide a continuous check on emissions levels.



Ash Lagoons:

The ash slurry from the air pollution control system is pumped to ash lagoons for onsite storage.

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With fewer landfills, where will Ontario trash go?

Waterloo Region Record

Garbage in Ontario is a mess.

Durham and York are building a controversial incinerator to burn 140,000 tonnes of garbage a year.

Guelph is just getting a handle on its wet waste again with its new compost facility for green bin garbage. It will also take food waste from homes in Waterloo Region.

Simcoe County — a community that attracts vacationers and retirees — faces a dire situation with less than six years of usability left for three of its four landfills.

Communities are flailing as they try to manage waste within their own borders. Some are already sending garbage out of town. Some are still working on setting waste diversion targets. Others are revising them. And some like Waterloo Region don't have waste diversion targets at all.

At least six communities surveyed by Metroland for this special report have landfills that will run out of space within 10 years. The mountains of trash that Ontarians are throwing into the garbage instead of their blue boxes are forcing our communities to try to find more space in their already bulging landfills.

But new landfills are difficult to build because the provincial government approvals required to create new facilities are hard to get, lengthy and costly.

"You can spend six, seven, eight years preparing and not get an approval at the end of the day," said Adam Chamberlain, a Toronto environmental lawyer. "Approving a landfill in Ontario is not for the faint of heart."

In fact, the Ministry of Environment hasn't approved a single new landfill site since 1999. During that time 147 small landfills have closed, leaving Ontario with 958 existing active landfills. But many of those are small and not classified as capable of taking on a major municipality's trash.

About 85 per cent of Ontario's waste goes to only 32 Ontario landfills classified by the ministry as "large."

The main reason trash is creating problems is that municipal landfills are filling up with garbage that should be recycled or reused, including cardboard, plastic bottles, milk cartons and paper.

The biggest offender is plastic.

A report by Stewardship Ontario shows that about 176,500 tonnes of plastics — including 30,906 tonnes of plastic bottles — were chucked into the garbage instead of the recycling box in 2009, the last year for which provincewide figures are available. That means three-quarters of all that plastic — including 44 per cent of plastic bottles — ends up in landfills.

Another culprit is paper packaging, the cardboard boxes and milk and juice containers that could be recycled as well. About 34 per cent of that material, or 122,396 tonnes, ends up in landfills too.

One Ontario landfill operator, Bob Beacock, regularly spots these recyclable items as they tumble out of the garbage trucks at the Brock site — east of Toronto. But he only has time to rescue the odd piece of scrap metal or tire.

"We can't just get out of the machine and start picking out pop cans," the Brock site operator said. "You just know you'd be here 16 hours a day. That's the public's obligation."

Municipalities say residents are still struggling to divert more waste.

Waterloo Region started a green bin pilot program in 2006, with all households participating by last fall. But the region finds residents still throw organics into the garbage.

"People realize that if your pizza boxes are greasy, it shouldn't go into the blue box but they haven't quite made the connection that it can go in the green bin," said Cari Howard, project manager for the Region of Waterloo's Waste Management Division.

In Toronto, residents are cautious about what they throw into the garbage because of a user fee, said city spokesperson Patricia Barrett. Each resident gets two free garbage tags a year to put out extra trash, but additional tags cost $3.10 each.

But Toronto's waste-diversion rate is still low at about 47 per cent.

Ontario's undiverted waste is aggravating landfill problems across the province.

Lafleche Environmental Inc.'s site near Moose Creek in Ottawa was the last new landfill approved in 1999, the ministry of the environment said. It was created on a former wetland about 70 km southeast of the capital.

Small landfills are closing up as smaller towns and cities find it cheaper and easier to pay a private landfill or another municipality to take their waste, said Chamberlain.

The Ontario municipalities whose landfills will overflow within 10 years include Simcoe County.

Simcoe County threw up its hands in 2009 after battling public opposition for 20 years over a new landfill called Site 41. Now six years are left at three of its sites. Staff are considering reopening two older landfills with some space left, exporting waste outside the county and working with neighbouring municipalities.

Durham Region is building a heavily protested incinerator to replace landfilling, and is currently sending most waste to Model City, N.Y. Its last landfill, Brock, will be out of space in two years, but Durham expects its incinerator to be open by then.

Many communities cannot afford to build an incinerator. They are simply trying to create more space within the landfills they own, despite opposition from environmentalists.

Niagara Region wants to expand Welland's Humberstone Landfill so it is able to accept waste for another 25 years. Right now, it will be at capacity in 2016. It is currently undergoing an environmental assessment expected to last about three years.

Waste at Humberstone is piled 12 metres above ground and the plan is to allow the piles to go another six metres higher than they are today.

"It is really about financial sustainability," said Andy Pollock, Niagara's director of waste management services.

He said that if Humberstone is expanded, Niagara taxpayers will save about $18 million over 20 years. Pollock said the expansion means the region would not have to pay to ship the trash to a private facility.

Despite the financial burden, Peterborough may choose to go through landfill expansion again, said Craig Simmons, Peterborough's co-ordinator of waste operations.

There was an expansion approved in 2004 that will keep the northern portion of the Peterborough landfill open for another 17 years. The southern portion closes next summer.

"In the long run, it was a better option to proceed with the landfill approvals instead of having to depend upon transferring the waste and being held ransom for unexpected increases in the cost of transporting the waste out of province," Simmons said.

Kawartha Lakes is one of the luckier municipalities. It has five landfills, although one will be full in two years. For the next 28 years, the community will have space for its trash. Waterloo Region expects to have space for its trash for 19 years or longer.

Other communities are not as fortunate.

Both of Northumberland county's landfills will be full in five years. The county has started an environmental assessment to expand its Brighton landfill for 11 more years. During that time it is working on a 25-year waste management plan.

In Muskoka, the Gravenhurst and Stisted landfills are set to close within six years, but the community got approval in 2009 to expand its Bracebridge site. It only had four years of capacity left, but now it can function until 2035. Muskoka expects Bracebridge will be the only landfill to handle all of its waste.

Environment Commissioner Gord Miller has expressed concern about the Ministry of Environment's oversight as landfills close.

In his 2010 report *Aging Landfills: Ontario's Forgotten Polluters*, Miller said aging landfills are not adequately inventoried or regularly inspected, and their approvals are not being updated by the province.

Miller also said the ministry has lost track of hundreds of aging landfills that threaten Ontario's water and air quality.

An inquiry by Metroland into how many of Ontario's 1,325 closed landfills have shut down in the last 10 years took ministry officials two weeks to determine.

Ministry officials said there is no central database with up-to-date records, and that they were not able to answer the question until calls had gone out to the ministry's 22 district and area offices.

Peter Tabuns, the NDP environment critic in the last legislature, said the ministry "is under-resourced and doesn't seem to have the comprehensive record-keeping or inspection that we need."

Conservative MPP Toby Barrett worried about the ministry's overall monitoring ability since leaching into groundwater is more significant with older landfills.

Overflowing landfills also have caused some municipalities to seek cross-border solutions for disposal of their trash.

The municipalities of Peel, Durham, York and Toronto, which have exhausted their own waste sites, used to truck garbage to Michigan, an agreement that ended in December, 2010. But other towns and cities still send their trash across the border.

Some municipalities are finding other states to take their garbage and organics.

Durham and Napanee are shipping waste to New York state. Durham says it is a temporary solution until its incinerator opens in 2014. Napanee's garbage has been going to New York after its landfill closed in June.

Guelph's wet waste went to an incinerator in Niagara Falls, New York after its old composter shut down in 2006. It just opened a new organics plant in September and is no longer sending organics across the border.

Some of York's organics also head to a compost facility in Marlborough, Mass., because the region's Ontario contractor cannot handle all the green bin waste.

Toronto bought the Green Lane landfill, near St. Thomas in 2007 and since January, all of Toronto's trash is disposed in the site. Guelph also sends its garbage there. York has a contract to use Green Lane for emergencies, while it sends most of its trash to a landfill in Niagara Falls.

Seeking U.S. answers for municipal waste is not the best solution, said Rob Cook, CEO of the Ontario Waste Management Association.

Ontarians should be self-sufficient, he said, and municipalities are handing over about $80 million to American landfills that could have gone to Ontario businesses.

There are also concerns about the border being closed to Ontario trash. Cook added that if there are any security issues, Ontario would be vulnerable.

For example, after Sept. 11, the border closed for two days and Toronto's trash could not be collected and it backed up the system.

"Managing our waste is a hard service like our waste water and we certainly wouldn't rely on the U.S. to give us water," he said.

Record news services

Waste-to-energy

From Wikipedia, the free encyclopedia
Jump to: navigation, search

Spittelau incineration plant is one of several plants that provide district heating in Vienna.

Waste-to-energy (WtE) or **energy-from-waste** (EfW) is the process of generating energy in the form of electricity and/or heat from the incineration of waste. WtE is a form of energy recovery. Most WtE processes produce electricity and/or heat directly through combustion, or produce a combustible fuel commodity, such as methane, methanol, ethanol or synthetic fuels.[1]

Contents

[hide]

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- 2 WtE technologies other than incineration
  - 2.1 Waste Plastic to energy
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- 4 Carbon dioxide emissions
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- 5 Examples of waste-to-energy plants
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Incineration[edit source | editbeta]

Main article: Incineration

Incineration, the combustion of organic material such as waste with energy recovery, is the most common WtE implementation. All new WtE plants in OECD countries incinerating waste (residual MSW, commercial, industrial or RDF) must meet strict emission standards, including those on nitrogen oxides (NO_x), sulphur dioxide (SO_2), heavy metals and dioxins.[2][3] Hence, modern incineration plants are vastly different from old types, some of which neither recovered energy nor materials. Modern incinerators reduce the volume of the original waste by 95-96 percent, depending upon composition and degree of recovery of materials such as metals from the ash for recycling.[4]

Incinerators may emit fine particulate, heavy metals, trace dioxin and acid gas, even though these emissions are relatively low[5] from modern incinerators. Other concerns include proper management of residues: toxic fly ash, which must be handled in hazardous waste disposal installation as well as incinerator bottom ash (IBA), which must be reused properly.[6]

Critics argue that incinerators destroy valuable resources and they may reduce incentives for recycling.[6] The question, however, is an open one, as countries in Europe recycling the most (up to 70%) also incinerate their residual waste to avoid landfilling.[7]

Incinerators have electric efficiencies of 14-28%.[6] In order to avoid losing the rest of the energy, it can be used for e.g. district heating (cogeneration). The total efficiencies of cogeneration incinerators are typically higher than 80% (based on the lower heating value of the waste), and may even exceed 100% when equipped with flue gas condensation.[8]

The method of using incineration to convert municipal solid waste (MSW) to energy is a relatively old method of waste-to-energy production. Incineration generally entails burning waste (residual MSW, commercial, industrial and RDF) to boil water which powers steam generators that make electric energy and heat to be used in homes, businesses, institutions and industries. One problem associated with incinerating MSW to make electrical energy, is the potential for pollutants to enter the atmosphere with the flue gases from the boiler. These pollutants can be acidic and in the 1980s were reported to cause environmental damage by turning rain into acid rain. Since then, the industry has removed this problem by the use of lime scrubbers and electro-static precipitators on smokestacks. By passing the smoke through the basic lime scrubbers, any acids that may be in the smoke are neutralized which prevents the acid from reaching the atmosphere and hurting the environment. Many other devices such as fabric filters, reactors and catalysts destroy or capture other regulated pollutants.[9] According to the New York Times, modern incineration plants are so clean that "many times more dioxin is now released from home

fireplaces and backyard barbecues than from incineration. "[10] According to the German Environmental Ministry, "because of stringent regulations, waste incineration plants are no longer significant in terms of emissions of dioxins, dust, and heavy metals".[11]

WtE technologies other than incineration[edit source | editbeta]

There are a number of other new and emerging technologies that are able to produce energy from waste and other fuels without direct combustion. Many of these technologies have the potential to produce more electric power from the same amount of fuel than would be possible by direct combustion. This is mainly due to the separation of corrosive components (ash) from the converted fuel, thereby allowing higher combustion temperatures in e.g. boilers, gas turbines, internal combustion engines, fuel cells. Some are able to efficiently convert the energy into liquid or gaseous fuels:

Thermal technologies:

- Gasification (produces combustible gas, hydrogen, synthetic fuels)
- Thermal depolymerization (produces synthetic crude oil, which can be further refined)
- Pyrolysis (produces combustible tar/biooil and chars)
- Plasma arc gasification or plasma gasification process (PGP) (produces rich syngas including hydrogen and carbon monoxide usable for fuel cells or generating electricity to drive the plasma arch, usable vitrified silicate and metal ingots, salt and sulphur)

Non-thermal technologies:

- Anaerobic digestion (Biogas rich in methane)
- Fermentation production (examples are ethanol, lactic acid, hydrogen)
- Mechanical biological treatment (MBT)
    - MBT + Anaerobic digestion
    - MBT to Refuse derived fuel

Waste Plastic to energy[edit source | editbeta]

Plastic Pyrolysis can convert petroleum based waste streams such as plastics into char, tar and pyrolysis gas.[12] Given below is the list of suitable plastic raw materials for pyrolysis:

- Mixed plastic (HDPE, LDPE, PE, PP, Nylon, Teflon, PS, ABS, FRP etc.)
- Mixed waste plastic from waste

Global WTE developments[edit source | editbeta]

During the 2001-2007 period, the WTE capacity increased by about four million metric tons per annum. Japan and China built several plants that were based on direct smelting or on fluidized bed combustion of solid waste. In China there are about 50 WTE plants. Japan is the largest user

in thermal treatment of MSW in the world with 40 million tons. Some of the newest plants use stoker technology and others use the advanced oxygen enrichment technology. There are also over one hundred thermal treatment plants using relatively novel processes such as direct smelting, the Ebara fluidization process and the Thermo- select -JFE gasification and melting technology process.[13] In Patras, Greece, a Greek company just finished testing a system that shows potential. It generates 25kwatts of electricity and 25kwatts of heat from waste water.[14] In India its first energy bio-science center was developed to reduce the country's green house gases and its dependency on fossil fuel.[15]

Biofuel Energy Corporation of Denver, CO, opened two new biofuel plants in Wood River, NE, and Fairmont, MN, in July 2008. These plants use distillation to make ethanol for use in motor vehicles and other engines. Both plants are currently reported to be working at over 90% capacity. Fulcrum BioEnergy incorporated located in Pleasanton, CA, is currently building a WTE plant near Reno, NV. The plant is scheduled to open in early 2010 under the name of Sierra BioFuels plant. BioEnergy incorporated predicts that the plant will produce approximately 10.5 million gallons per year of ethanol from nearly 90,000 tons per year of MSW.(Biofuels News)

Waste to energy technology includes fermentation, which can take biomass and create ethanol, using waste cellulosic or organic material. In the fermentation process, the sugar in the waste is changed to carbon dioxide and alcohol, in the same general process that is used to make wine. Normally fermentation occurs with no air present. Esterification can also be done using waste to energy technologies, and the result of this process is biodiesel. The cost effectiveness of esterification will depend on the feedstock being used, and all the other relevant factors such as transportation distance, amount of oil present in the feedstock, and others.[16] Gasification and pyrolysis by now can reach gross thermal conversion efficiencies (fuel to gas) up to 75%, however a complete combustion is superior in terms of fuel conversion efficiency.[17] Some pyrolysis processes need an outside heat source which may be supplied by the gasification process, making the combined process self-sustaining.

Carbon dioxide emissions[edit source | editbeta]

In thermal WtE technologies, nearly all of the carbon content in the waste is emitted as carbon dioxide (CO_2) to the atmosphere (when including final combustion of the products from pyrolysis and gasification; except when producing bio-char for fertilizer). Municipal solid waste (MSW) contain approximately the same mass fraction of carbon as CO_2 itself (27%), so treatment of 1 metric ton (1.1 short tons) of MSW produce approximately 1 metric ton (1.1 short tons) of CO_2.

In the event that the waste was landfilled, 1 metric ton (1.1 short tons) of MSW would produce approximately 62 cubic metres (2,200 cu ft) methane via the anaerobic decomposition of the biodegradable part of the waste. This amount of methane has more than twice the global warming potential than the 1 metric ton (1.1 short tons) of CO_2, which would have been produced by combustion. In some countries, large amounts of landfill gas are collected, but still the global warming potential of the landfill gas emitted to atmosphere in e.g. the US in 1999 was

approximately 32% higher than the amount of CO_2 that would have been emitted by combustion.[18]

In addition, nearly all biodegradable waste is biomass. That is, it has biological origin. This material has been formed by plants using atmospheric CO_2 typically within the last growing season. If these plants are regrown the CO_2 emitted from their combustion will be taken out from the atmosphere once more.

Such considerations are the main reason why several countries administrate WtE of the biomass part of waste as renewable energy.[19] The rest—mainly plastics and other oil and gas derived products—is generally treated as non-renewables.

Determination of the biomass fraction[edit source | editbeta]

MSW to a large extent is of biological origin (biogenic), e.g. paper, cardboard, wood, cloth, food scraps. Typically half of the energy content in MSW is from biogenic material.[20] Consequently, this energy is often recognised as renewable energy according to the waste input.[21]

Several methods have been developed by the European CEN 343 working group to determine the biomass fraction of waste fuels, such as Refuse Derived Fuel/Solid Recovered Fuel. The initial two methods developed (CEN/TS 15440) were the **manual sorting method** and the **selective dissolution method**. A detailed systematic comparison of these two methods has been recently[*when?*] published.[22] Since each method suffered from limitations in properly characterizing the biomass fraction, two alternative methods have been developed.

The first method uses the principles of radiocarbon dating. A technical review (CEN/TR 15591:2007) outlining the carbon 14 method was published in 2007. A technical standard of the carbon dating method (CEN/TS 15747:2008) will be published in 2008.[*dated info*] In the United States, there is already an equivalent carbon 14 method under the standard method ASTM D6866.

The second method (so-called **balance method**) employs existing data on materials composition and operating conditions of the WtE plant and calculates the most probable result based on a mathematical-statistical model.[23] Currently the balance method is installed at three Austrian and eight Danish incinerators.

A comparison between both methods carried out at three full-scale incinerators in Switzerland showed that both methods came to the same results.[24]

Carbon 14 dating can determine with precision the biomass fraction of waste, and also determine the biomass calorific value. Determining the calorific value is important for green certificate programs such as the Renewable Obligation Certificate program in the United Kingdom. These programs award certificates based on the energy produced from biomass. Several research papers, including the one commissioned by the Renewable Energy Association in the UK, have been published that demonstrate how the carbon 14 result can be used to calculate the biomass calorific value. The UK gas and electricity markets authority, Ofgem, released a statement in

2011 accepting the use of Carbon 14 as a way to determine the biomass energy content of waste feedstock under their administration of the Renewables Obligation.[25] Their Fuel Measurement and Sampling (FMS) questionnaire describes the information they look for when considering such proposals.[26]

Examples of waste-to-energy plants[edit source | editbeta]

According to ISWA there are 431 WtE plants in Europe (2005) and 89 in the United States (2004).[27] The following are some examples of WtE plants.

Waste incineration WtE plants

- Lee County Solid Waste Resource Recovery Facility, Fort Myers, Florida, USA (1994) [28]
- Montgomery County Resource Recovery Facility in Dickerson, Maryland, USA (1995)
- Spittelau (1971), and Flötzersteig (1963), Vienna, Austria (Wien Energie)
- SYSAV in Malmö (2003 and 2008), Sweden (Flash presentation)
- Algonquin Power, Brampton, Ontario, Canada [29]
- Teesside EfW plant near Middlesbrough, North East England (1998)
- Edmonton Incinerator in Greater London, England (1974)
- Burnaby Waste-to-Energy Facility, Metro Vancouver, Canada (1988).

Liquid fuel producing plants (planned or under construction)

- Edmonton Waste-to-ethanol Facility, Enerkem-process, fueled by RDF, initially scheduled for completion 2010,[30] now expected operational in 2013,[31] Edmonton, Alberta, Canada.
- Mississippi Waste-to-ethanol Plant, Enerkem-process, initially scheduled for completion 2013. Pontotoc, Mississippi, USA.[32] As of March 2013 still in under development, but expected operational during 2015.[33]

Plasma Gasification Waste-to-Energy plants

- The US Air Force Transportable Plasma Waste to Energy System (TPWES) facility (PyroGenesis technology) at Hurlburt Field, Florida.[34]

Besides large plants, domestic waste-to-energy incinerators also exist. For example, the refuge de Sarenne has a domestic waste-to-energy plant. It is made by combining a wood-fired gasification boiler with a Stirling motor.[35][36]

See also[edit source | editbeta]

Energy portal

- Biohydrogen production
- Biomass
- Cogeneration
- Energy recycling
- List of solid waste treatment technologies
- List of waste management acronyms
- Manure-derived synthetic crude oil
- Refuse-derived fuel
- Relative cost of electricity generated by different sources
- Waste heat
- Waste management

References[edit source | editbeta]

1. ^ NW BIORENEW
2. ^ "Waste incineration". Europa. October 2011.
3. ^ "DIRECTIVE 2000/76/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 December 2000 on the incineration of waste". European Union. 4 December 2000.
4. ^ Waste to Energy in Denmark by Ramboll Consult
5. ^ Emissionsfaktorer og emissionsopgørelse for decentral kraftvarme, Kortlægning af emissioner fra decentrale kraftvarmeværker, Ministry of the Environment of Denmark 2006 (in Danish)
6. ^ a b c Waste Gasification: Impacts on the Environment and Public Health
7. ^ "Environment in the EU27 Landfill still accounted for nearly 40% of municipal waste treated in the EU27 in 2010". European Union. 27. March 2012.
8. ^ "Waste-to-energy Plant Amager Bakke, Copenhagen, Denmark, Plant fact sheet". Babcock Wilcox Volund.
9. ^ "Waste–to–Energy in Austria, White Book, 2nd Edition 2010". Austrian Ministry of Life.
10. ^ Rosenthal, Elisabeth (12 April 2010). "Europe Finds Clean Energy in Trash, but U.S. Lags". *The New York Times*.
11. ^ "Waste incineration – A potential danger? Bidding farewell to dioxin spouting" (PDF). Federal Ministry for Environment, Nature Conservation and Nuclear Safety. September 2005.
12. ^ "Plastic Pyrolysis Plant". RESEM Group China. Retrieved 2013-03-07.
13. ^ columbia university
14. ^ clean-tech-Greece
15. ^ clean-tech- India
16. ^ bionomic fuel
17. ^ *The Viability of Advanced Thermal Treatment of MSW in the UK* by Fichtner Consulting Engineers Ltd 2004
18. ^ Themelis, Nickolas J. An overview of the global waste-to-energy industry, Waste Management World 2003
19. ^ [1], from the homepage of the UK Renewable Energy Association
20. ^ "More recycling raises average energy content of waste used to generate electricity". U.S. Energy Information Administration. September 2012.
21. ^ "Directive 2009/28/EC on the promotion of the use of energy from renewable sources". European Union. April 23. 2009.

22. ^ *The biogenic content of process streams from mechanical–biological treatment plants producing solid recovered fuel. Do the manual sorting and selective dissolution determination methods correlate?* by Mélanie Séverin, Costas A. Velis, Phil J. Longhurst and Simon J.T. Pollard., 2010. In: *Waste Management* 30(7): 1171-1182
23. ^ *A New Method to Determine the Ratio of Electricity Production from Fossil and Biogenic Sources in Waste-to-Energy Plants.* by Fellner, J., Cencic, O. and Rechberger, H., 2007. In: *Environmental Science & Technology,* 41(7): 2579-2586.
24. ^ *Determination of biogenic and fossil CO_2 emitted by waste incineration based on $^{14}CO_2$ and mass balances.* by Mohn, J., Szidat, S., Fellner, J., Rechberger, H., Quartier, R., Buchmann, B. and Emmenegger, L., 2008. In: *Bioresource Technology,* 99: 6471-6479.
25. ^ http://www.ofgem.gov.uk/Sustainability/Environment/RenewablObl/FuelledStations/Documents1/14C%20publicity.pdf
26. ^ http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=363&refer=Sustainability/Environment/RenewablObl/FuelledStations
27. ^ Energy from Waste State-of-the-Art Report, Statistics 5th Edition August 2006. International Solid Waste Association (ISWA)
28. ^ Energy-from-Waste facility in Lee County run as Covanta Lee, Inc.
29. ^ Algonquin Power Energy from Waste Facility from the homepage of Algonquin Power
30. ^ "Enerkem to Squeeze Biofuel Out of Old Electricity Poles". gigaom.com. January 13. 2009.
31. ^ Waste-to-Biofuel Facility from the website of City of Edmonton, Alberta.
32. ^ Enerkem. Pontotoc MSW-to-Biofuels plant.
33. ^ "Enerkem 'committed' to Pontotoc ethanol project". djournal.com. March 10. 2013.
34. ^ "AFSOC makes 'green' history while investing in future". US Air Force Special Operations Command. Retrieved 2011-04-28..
35. ^ Refuge de Sarenne waste incinerator hooked up to Stirling motor
36. ^ Refuge de Sarenne using wood-fired gasification boiler

Further reading[edit source | editbeta]

- Field, Christopher B. "Emissions pathways, climate change, and impacts." PNAS 101.34 (2004): 12422–12427.
- Sudarsan, K. G., and Mary P. Anupama. "The Relevance of Biofuels." Current Science 90.6 (2006): 748. 18 Oct. 2009 <http://www.iisc.ernet.in/currsci/mar252006/748a.pdf>.
- Tilman, David. "Environmental, economic, and energetic costs." PNAS 103.30 (2006): 11206–11210.
- "Biofuels News". Chemical Engineering Progress. . FindArticles.com. 18 Oct. 2009. <Http://findarticles.com/p/articles/mi_qa5350/is_200808/ai_n28083407>
- "Waste to Ethanol." Centurymarc. 2007. 10

External links[edit source | editbeta]

- Waste-to-Energy Research and Technology Council
- WtERT Germany
- LowCarbonEconomy.com
- Gasification Technologies Council

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Waste and waste management

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Recycling

Categories:

- Bioenergy
- Waste management
- Waste treatment technology

Municipal Waste Generation

Municipal Waste Generation

Amount of municipal waste generated per capita, measured in kilograms.

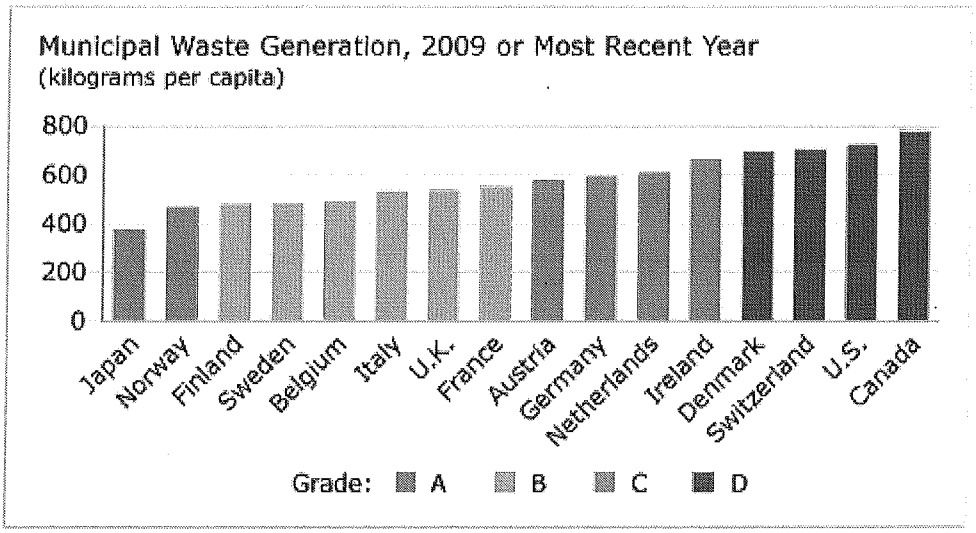
Please note:
The data on this page are current as of January 2013.

Key Messages

Canada ranks in last place out of 17 countries and gets a "D" grade on the municipal waste eneration report card.

Canada produced 777 kg per capita of municipal waste in 2008, twice as much as the best erformer, Japan.

Canada's municipal waste generated per capita has been steadily increasing since 1990.



Putting municipal waste in context

Any waste collected by or on the order of municipalities falls under the definition of municipal waste. According to the Organisation for Economic Co-operation and Development (OECD), municipal waste is "waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste."[1]

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How does Canada perform relative to its peer?

Canada generates more municipal waste per capita annually than any of its peer countries. Canada earns a "D" grade and ranks in last place. In 2008, Canada generated 777 kg per capita of municipal waste—well above the 17-country average of 578 kg per capita and twice as much as Japan, the top-performing country.

Why do Canadians generate so much municipal waste?

Increases in municipal waste generation are related to rates of urbanization, types and patterns of consumption, household revenue, and lifestyles. Canada's per capita income and average household disposable income have been steadily increasing since the 1980s, leading to increasing household consumption rates.

In other OECD counties where urbanization and disposable household income are also high, however, municipal waste generated per capita is substantially lower than in Canada. Japan, for example, generated 377 kg per capita of municipal waste in 2008, while Norway generated 470 kg per capita in 2009.

For information on Japan's and Finland's innovative approaches to sustainable waste management, see the hot topic "What can Canada learn from other countries to improve its Environment report card?"

Has Canada's report card on municipal waste improved?

REPORT CARD

Municipal Waste Generation Per Capita

	1990s	2000s
Australia	D	n.a.
Austria	A	B
Belgium	A	A
Canada	C	D
Denmark	B	C
Finland	A	A
France	B	B
Germany	C	B
Ireland	B	D
Italy	A	B
Japan	A	A
Netherlands	B	C
Norway	B	A
Sweden	A	A
Switzerland	C	C
U.K.	B	B
U.S.	D	D

Source: The Conference Board of Canada.

No. In the 1990s, Canada received a "C" grade. Australia and the U.S. had higher per capita municipal waste than Canada.

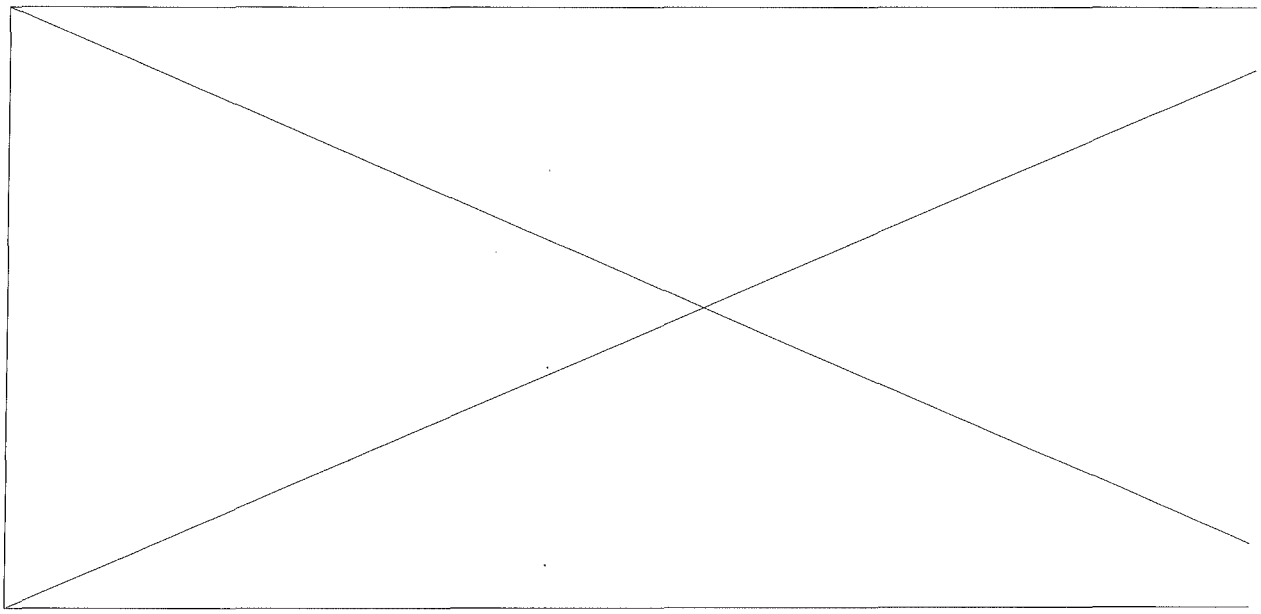
But by 2002, Canada's per capita municipal waste was worse than in the United States. Canada's grade fell to a "D."

Is Canada the only country to see a steady increase in municipal waste?

No. Across the OECD, the quantity of municipal waste generated per capita has been rising. In 1995, for example, the average amount of municipal waste generated by the 17 countries ranked by the Conference Board was 536 kg per capita. By the late 2000s, the average had increased to 578 kg per capita.

Some of Canada's peer countries have, however, managed to keep the amount of municipal waste generated per capita steady, despite economic growth. Between 1990 and 2007, Japan sustained its municipal waste generation at about 400 kg per capita, while Norway managed to reduce its per capita volumes of disposable solid waste. However, most other countries recorded significant increases in municipal waste generation.

Use the drop-down menu to compare the change in Canada's municipal waste generation with that of its peer countries.



What are the environmental issues associated with municipal waste?

Municipal waste contributes to environmental problems including habitat destruction, surface and groundwater pollution, and other forms of air, soil, and water contamination. Incineration creates toxic substances, while landfills emit methane (which contributes to global warming) and other gases.[2]

Does Canada manage its municipal waste in a sustainable way?

In 2008, nearly 13 million tonnes of waste were generated by Canadian households.[3] Of this, more than 8.5 million tonnes were disposed of in landfills or incinerators; the remaining 4.4 million tonnes were diverted through recycling, reuse, or composting. Paper fibres and organic materials make up the largest proportion of household material that is recycled and composted in Canada.[4]

Within each province, individual municipalities are responsible for waste management programs. Many Canadian municipalities have developed and initiated successful recycling programs that reduce the amount of waste that goes to landfills. Recycling, which has significantly increased in Canada, generally has less impact on the environment than manufacturing new materials into usable products. For example, studies have shown that producing paper from recycled materials uses less energy and creates fewer air and water emissions and less solid waste.[5] But recycling operations still require energy and water, and can cause a number of environmental impacts. They therefore need to be managed effectively.[6]

Landfilling is still the most common way to dispose of waste in Canada. Most municipal waste goes to landfill, with only a small percentage incinerated.[7] Environmental concerns about landfills include the leachate and landfill gases that contaminate groundwater and surface water and contribute to climate change.

Municipalities are consequently faced with finding a viable and sustainable location for waste disposal. Although there is ample space to create landfill sites in Canada, many residents are opposed to having landfills close to their communities. In the 1990s, when Toronto's Keele Valley landfill reached near capacity and closure appeared imminent, the municipality proposed shipping its waste 590 kilometres north, by rail, to Kirkland Lake, Ontario. The 9,000 residents of Kirkland Lake were up in arms at the thought of having Toronto's municipal waste dumped into an abandoned mine in their community. In the end, the community won, and the decision to use the mine was overturned by Toronto City Council. Between 2003 and 2010, Toronto's municipal waste was exported to a landfill site in Michigan, but transporting waste has other environmental impacts. As of January 1, 2011, all of Toronto's waste requiring landfill disposal is now sent to its Green Lane Landfill Site in southwestern Ontario.[8]

What does Canada need to do to improve its sustainable waste management practices?

Municipal waste management is expensive. Municipal governments in Canada spent more than $1.8 billion on waste collection, transport, and disposal in 2008.[9]

Canada needs to further integrate waste management systems while making reduced environmental impact a top priority. To achieve more sustainable municipal waste management practices, the challenge will be to reduce the amount of solid waste generated, while increasing the amount of waste diverted from landfills through recycling and other initiatives in an economically feasible way. Canadians must also realize that economic growth cannot come at the expense of the environment.

For information on how some cities are adopting the concept of industrial ecology to reduce waste, see: "Environmentally Sound Growth" in chapter 4 of *Mission Possible: Successful Canadian Cities*.

Footnotes

1 OECD, *OECD Environmental Data Compendium 2004* (Paris: OECD, 2005).
2 David R. Boyd, *Canada vs. the OECD: An Environment Comparison,* 2001 (accessed August 19, 2008).
3 Statistics Canada, *Waste Management Industry Survey: Business and Government Sectors 2008* (Ottawa: Statistics Canada, 2010), Catalogue no. 16F0023X, 14.
4 Ibid., 16.
5 P.T. Williams. "Emissions from Solid Waste Management Activities," in *Environmental and Health Impact of Solid Waste Management Activities,* R.E. Hester and R.M. Harrison, eds. (Cambridge: The Royal Society of Chemistry, 2002).
6 Statistics Canada, *Human Activity and the Environment, Annual Statistics 2005, Solid Waste in Canada* (Ottawa: Minister of Industry, 2005), 7.
7 David R. Boyd, *Canada vs. the OECD: An Environment Comparison,* 2001 (accessed August 19, 2008).
8 City of Toronto, "Facts about Toronto's trash" (accessed June 15, 2011).
9 Statistics Canada, *Waste Management Industry Survey: Business and Government Sectors 2008* (Ottawa: Statistics Canada, 2010), Catalogue no. 16F0023X, 8.

Environment Indicators

See discussions on other indicators

Nitrogen oxides emissions
Sulphur oxides emissions
VOC emissions
PM10 concentration
Municipal waste generation
Water Quality Index
Water withdrawls
Threatened species
Forest cover change
Use of forest resources
Marine Trophic Index
GHG emissions
Low-emitting electricity production
Energy intensity

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BP-407E

THE GARBAGE CRISIS: TRADITIONAL SOLUTIONS

Prepared by:
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Science and Technology Division
December 1995

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THE GARBAGE CRISIS:
TRADITIONAL SOLUTIONS

INTRODUCTION

As long ago as 500 BC, the city state of Athens decreed that wastes must be transported beyond the city gates for disposal. While the challenge of waste disposal has confronted mankind for millennia, the problem has become acute only within the past few decades and is primarily localized in the developed world. In essence, garbage is a by-product of prosperity.

For most of Canada's history, garbage disposal was not a concern. Wide open spaces, a sparse, largely agrarian population, and the strong ethic of "waste not, want not" precluded the need for centralized waste management in all but a few large urban centres. Frugality, coupled with a lack of readily available consumer products, meant that many used materials were mended or reworked into new goods. What was not made over was composted, burnt for heat or carted away, for example by the scrap-metal dealer and the "rags-and-bones man."

The end of World War II ushered in a new era of Canadian prosperity and the beginning of the consumer society. The rise of self-service merchandising spawned the need for new packaging materials to both protect and help sell products. Today, packaging comprises one-third of solid waste. In addition, the Canadian shift toward an industrial-based economy promoted the growth of cities and towns. Virtually all Canadian urban centres, and even villages, have weekly curb-side garbage pick-up. This service is paid for through municipal property taxes and no direct waste removal charge is levied. As a result, the real cost of managing garbage has been hidden and there has been no apparent financial incentive for the homeowner to adopt alternative forms of waste management. Today, however, many factors are conspiring to provoke citizen resistance, slowing the Canadian shift to a "disposable society." Many people simply do not feel comfortable about the huge volumes of garbage they tote to the curb each week. Others realize that much of their "waste" retains some value (energy, fibre, metal) and they feel guilty that it is being entombed in landfills.

For much of this century, a large portion of urban waste was incinerated. The municipal incinerators were simple furnaces lacking today's high-technology pollution control devices. Neighbourhoods near an incinerator were often subjected to air pollution in the form of smoke and the deposition of particulate matter. Worse, soil analyses in areas close to incinerators have indicated heavy metal and dioxin contamination. The discovery of compounds that pose a potential health hazard resulted in the closure of old incinerators and prompted strong public resistance to their replacement by new state-of-the-art incinerators.

Landfills also engender feelings of aversion, for, like their predecessor, the town

dump, they are believed to be dusty, smelly, smoky and vermin-infested. In addition to aesthetic concerns, there is the worry that liquid wastes may seep from the dump site and compromise ground water quality. Finally, it is widely believed that available landfills will soon be used up and that there is no room for new landfills. This view is only partially correct; landfill space is at a premium but there are still numerous possible sites. The problem is that no one wants to leave near a landfill. In addition to the possible damage to the aesthetic environment, a landfill leads to increased neighbourhood truck traffic. As well, there is resentment and injured pride to contend with, as no community wants to be seen as the dumping ground for someone else's garbage. Probably of most concern is the fact that property values tend to decrease with increasing proximity to a landfill.

THE WASTE MANAGEMENT HIERARCHY

In the early 1980s, it became apparent to municipal solid waste (MSW) managers that a garbage crisis was imminent in Canada's more heavily populated regions. Studies of effective waste management options consistently indicated that the frugal practices of a century ago held the greatest promise of lessening the need for new landfills and incinerators. These practices have been termed the "3 Rs": reduce consumption of disposable consumer products, particularly packaging materials; re-use materials wherever possible; and remake or recycle used items.

The 3 Rs are not of equal environmental benefit. Reducing the volume of goods generated and discarded is Canada's number one waste management priority. This is followed by re-use; recycling is considered the least attractive option of the three. MSW managers recognize that waste management cannot be accomplished by one means. Indeed, there will always be some materials that cannot be re-used or recycled. If these materials are combustible, it is felt they should be incinerated and the released energy used for heating or generating electricity. For non-combustible materials that cannot be re-used or recycled, landfilling remains the only waste management option.

The usually accepted waste management hierarchy (reduce, re-use, recycle, incinerate, landfill) does not necessarily hold for all Canadian municipalities. Recycling is of economic and environmental benefit in Ontario's Golden Horseshoe, but it makes little economic sense in Rankin Inlet. In Kirkland Lake, where a large percentage of the waste stream is wood debris, incineration and generation of electricity is the favoured waste management option.

A. Reduce

"Reduce" means reducing the amount of waste produced at the source. The consumer can contribute to source reduction by living more simply, by choosing not to buy or accept disposable products or packaging, and by complaining to manufacturers about over-packaging. The manufacturer can design new products with waste reduction in mind, use lighter weight packaging or none at all, and

improve industrial processes so that they do not produce as much waste. Action on this front, however, has not been sufficient to stem the ever increasing volume of waste generated in Canada and it is recognized that future success depends on the development of provincial and national waste reduction policies.

In 1988, the Canadian Council of Ministers of the Environment (CCME) studied this issue and, in 1989, set a nation-wide waste reduction goal of 50% for the year 2000. In quantitative terms, this means that the 1.8 kg of waste generated per person per day in 1988 is to be reduced to 0.9 kg. To help achieve this goal, the CCME, in consultation with all the provinces and territories, the federal government, municipalities, industries, and environmental groups, developed the *National Packaging Protocol*. At present, this is a voluntary program that involves consumers, retailers and manufacturers; however, the protocol states that regulations will be implemented if necessary to ensure compliance with protocol policies. A national packaging monitoring system has been established to measure progress towards the stated objectives of a 20%, 35% and 50% reduction in packaging sent for disposal (incineration or landfill) by 31 December 1992, 1996 and 2000, respectively. It should be noted that in the *National Packaging Protocol* "reduction" means any action that reduces the amount of material going to incinerators or landfills; thus, the re-use or recycling of material counts as reduction.

B. Re-use

"Re-use" implies using an item repeatedly rather than throwing it away. The most familiar form of re-use is the refillable return-for-deposit beer bottle. As well, organizations such as the Salvation Army run long-established repair and re-use systems for clothing, furniture and appliances. Parts taken from old automobiles and appliances are examples of items that are re-used.

Re-use results in significant reduction at source. When old parts that are operational are used again, there is a decreased need for the manufacture of new parts; natural resources in the form of virgin materials and energy expended in manufacturing are saved, while the associated emissions to air, soil and water are eliminated. Using refillable containers has an additional environmental advantage over recycling used packaging. When purchasing beer, the consumer brings back used bottles to the beer store in the same trip; and after delivering beer to the store, the empty truck carries the used bottles back to the brewery for washing and refilling. In other words, there are no extra trips and thus there is an economy of transportation. In contrast, recycled materials have to be picked up at curbside by specially equipped trucks, or be taken by the homeowner in a special trip to a neighbourhood recycling depot, from where they are trucked to a recycling centre. Following sorting and baling, the materials are then transported to a reprocessing plant anywhere from a few to thousands of kilometres away.

Given the energy and environmental advantages of re-use over recycling, it may

seem unusual that governments at all levels have not facilitated material re-use schemes by means of regulation or subsidies. The reason is that the North American system of long-distance one-way distribution of goods does not encourage deposit-return schemes. For example, a vegetable processing plant in Leamington, Ontario, may ship bottles of tomato juice to Calgary by means of an independent trucking company. The truck is not then available to transport low-value juice bottles back to Leamington, however; rather, its next cargo may be beef destined for Vancouver, or Japanese auto parts bound for Dallas. The deposit-return system for refillable containers is practical only for local or regional distribution of goods; for example, beer store to brewery, and, as in Great Britain, from doorstep to dairy.

Regulations to promote the re-use of materials would give independent, locally based producers a market advantage over centralized production and long-distance distribution. Indeed, large multinational companies have called the mandatory deposit and return systems a barrier to free trade.(1) During the mid-1980s, Coca-Cola Ltd. and Pepsi-Cola Canada Ltd., with a one-time $20-million set-up fund, kick-started Ontario's blue box recycling program. This encourages a product distribution system of one-way pop cans and plastic bottles, with the taxpayer carrying the cost of recycling. According to the *Financial Times of Canada*: "80% of the independent bottlers in the province were bought up or closed down as Coca-Cola and Pepsi-Cola centralized production in suburban Toronto."(2) Toronto-based Pollution Probe estimates that eliminating the need for refillable containers saves these two beverage distributors $60 to $80 million a year.(3)

Today in Canada, the dairy industry no longer supplies products in refillable receptacles, soda is primarily available in one-way plastic or aluminum containers, and increased competition from large centralized breweries in the United States has resulted in a steady decline in the Canadian beer industry's use of refillable beer bottles. The move to aluminum beer cans is most notable in western Canada. The net result is that re-use is the least successful of the 3 Rs; as a waste reduction strategy it is actually declining in importance.

C. Recycle

From an environmental point of view, re-use is clearly superior to recycling as a waste management option. In turn, however, recycling operations in the more densely populated regions of Canada and the United States have been shown to have distinct economic and environmental advantages over landfilling or incineration. The Tellus Institute, a public-interest environmental research group in Boston, studied the "full life-cycle" costs of recycling, including transport and reprocessing, and compared them with the costs of landfilling or incinerating the same waste, and the costs of making new products out of "virgin" materials. It was concluded that recycling wins out for aluminum, paper, glass, cardboard and most other recyclable wastes. The exception was plastics, which are relatively cheap to make, but expensive to recycle because, though many plastic materials look

similar, they are chemically incompatible and must be sorted. This situation may be eased by the development of new technologies that depolymerize plastics to feedstock components. Recycling operations are generally most successful in populated regions where economy-of-scale results in comparatively low per capita collection costs, waste undergoes residential "pre-sorting," distances from recycling depots to reprocessing centres are short, and landfill tipping fees are high.

In Canada and the United States, a number of factors have conspired to make recycling a widespread waste management choice. The concept of recycling has been warmly embraced by the public as environmentally correct. This acceptance, plus the need to ease pressure on rapidly filling landfills, has prompted a number of governments to introduce recycling ventures and to subsidize these operations until they start to become self sufficient. Also, as mentioned, some large beverage companies have contributed funds to help kick-start regional recycling operations. A major inducement, however, has been the development of government policies and legislation that create markets for recycled materials. Many governments have established procurement policies that favour recycled products, others provide low-interest loans, grants or tax credits to companies that make products from recycled materials. In the more populous regions of the United States, in order to divert used newspapers from diminishing landfill space, many state and municipal governments have enacted legislation setting a minimum recycled fibre content for newsprint. In response, Canada's pulp and paper industry had to scramble to install paper recycling capacity in order not to lose American newsprint markets. The legislation was so effective that an increasing number of jurisdictions are now establishing recycled content standards for glass and plastic containers.

A municipal solid waste study in an Ontario region indicated that, in theory, slightly more than 60% of wastes could be recycled or composted. Recyclable wastes included paper (29.7%), plastics (8.2%), ferrous metals (5.0%), glass (2.5%), non-ferrous metals (0.8%), and compostable yard trimmings (14.7%). The balance of the waste stream was composed of hazardous waste (0.3%) and organic and inorganic wastes (38.8%) such as inert construction debris, ceramics, leather, toys, food wastes, etc. It should be noted, however, that vegetative food wastes may also be composted and diverted from landfills.

Although it may be possible to divert up to 60% of municipal solid waste from landfills, recycling rates of 40% are considered very good, even in Japan and western European countries where recycling has been on-going for many years. In Canada and the United States, recycling operations are usually diverting only somewhat more than 10% of the waste stream, though in some areas it is almost 20%. These relatively low rates are a reflection of growing pains. When a recycling program starts up, the product line is usually limited to items that are easy to collect and sort and for which there is a strong market. Accordingly, blue box operations at first collected just newspapers, metal cans and glass. Now, depending upon the area, collection has been extended to "type 1" plastics or all

types of plastic and, where economy-of-scale warrants, cardboard materials. In urban Canada, most recycling operations are showing a slow but constant increase in volume and a steady move toward a better financial position.

Recycling is expensive. In most jurisdictions, the move to recycling has necessitated the purchase of a second fleet of specially designed trucks. For example, Los Angeles had to augment its fleet of 1,000 garbage trucks with 600 recycling trucks. In nearly all areas, recyclable materials are collected separately from garbage, thus doubling the distance travelled and greatly increasing fuel and labour costs. Materials must be sorted and baled at a central depot and then transported to a reprocessing plant; again incurring labour, operating and capital costs. Waste Management Inc., one of the largest waste management companies in the United States, has reported that according to its experience with 5.2 million households in 600 communities,(4) collection and sorting of for recycled material costs $175 ($227 CDN)(5) per tonne. Worse, a Pennsylvania study showed that it cost Pittsburgh residents $94 ($122 CDN) per tonne for regular MSW and $470 ($611 CDN) per tonne for recyclable material. Although Pittsburgh probably has the highest recycling cost in North America, recycling 1 tonne of material in the United States generally costs three to four times more than landfilling it. This large difference is due in part to the very low tipping fees at landfills away from the populous north-eastern seaboard, and to the higher costs of curb-side pick up of mixed recyclable materials followed by depot sorting. In contrast, the economics of recycling tend to be more favourable in Canada where tipping fees are often high and where homeowners voluntarily pre-sort recyclable materials.

Data collected by the Environmental Services Department of the regional municipality of Ottawa-Carleton provide a snapshot of a regional recycling program that is just at the point of showing economic and environmental benefits. Waste management data for 1994 is presented in Table 1. The blue box recycling program diverted 29,921 tonnes of recyclable material from landfills at a cost of $172 per tonne, or $63 per tonne more than if the material had been landfilled at $109. Leaf and yard waste was also collected, composted, and used for city parks and gardens. In addition, Christmas trees were collected and chipped and used as landscaping material. Composting and chipping diverted 8,232.5 tonnes of vegetative matter from the landfill at a cost of $77 per tonne, a savings of $32 per tonne. As a result, approximately 21% of the region's waste management budget was spent on diverting 16% of the region's waste from landfills.

Table 1: Municipal Solid Waste Management in Ottawa-Carleton

Waste Type		Cost $	
	Tonnes	Per Tonne	Per Total Tonnage
Landfill garbage	201,115	109	21,921,535
Blue box recycling	29,921	172	5,147,412
Leaf, yard waste composting and Christmas tree chipping	8,232.5	77	633,902
Total	239,268.5	-	27,702,849

The above analysis does not take into account the financial return to the private waste companies from the sale of recyclable materials. Table 2 shows the tonnages processed and the prices received by such a company: for a one-month period in early 1995, 2,852 tonnes were processed and sold for a gross income of $263,890, or $92.53 per tonne. Had the various Ottawa-Carleton municipalities not granted the private company full ownership of the collected materials, the cost of recycling might have been reduced to below the $109 cost of landfilling: $172 - ($92.53 - labour, operating and capital expenses). Many of the municipalities in Ottawa-Carleton are now renegotiating new waste contracts that claim a portion or all of the profits from the sale of recyclable materials.

Table 2: Blue Box Tonnages Processed at an Ottawa Recycling Depot

Product	Tonnes Per Month	End Market	$ Per Tonne	$ Per Total Tonnage
Newspaper	1,700	Avenor Gatineau, Quebec	62.00	105,400
Flint Glass	330	Consumer's Glass Toronto, Ontario	47.00	15,510
Coloured Glass	300	Consumer's Glass Toronto, Ontario	42.00	12,600
Tin	180	Metal Recovery Hamilton, Ontario	93.00	16,740
Aluminum	35	Alcan Oswego, New York	2,006.00	70,210
P.E.T.	20	Plastrek Bentierville, Quebec	350.00	7,000
Textiles	5	Recycling Together Ottawa, Ontario	Donated	0
Telephone Books	30	Thermo-Cell Gloucester, Ontario	0	0
Kraft Bags	55	APC Paper Co. Clairmont, N.H.	100.00	5,500
Mixed Fibre	190	MacMillan Bloedel Sturgeon Fall, Ont.	165.00	31,350
Mixed Plastic	7	Everwood Aylmer, Ontario	-60.00	-420
TOTAL	2,852			263,890

In the short term, even with improved prices and markets, it does not appear that the sale of recyclable materials will cover the cost of collection; on the other hand, sufficient revenues may be generated to make recycling less expensive than landfilling. Accordingly, in Ottawa-Carleton, recycling, composting, and tree

chipping already have the potential to save both landfill space and taxpayer dollars. The economics of recycling are even better in a number of municipalities in Ontario's Golden Horseshoe. This does not imply, however, that recycling is a sensible waste management option for all municipalities.

In 1993, Ontario was the first province in Canada to make recycling mandatory in all cities and towns with a population greater than 5,000. To help establish a recycling infrastructure, the province committed $26.3 million per annum until 31 March 1996, at which time it was expected that municipalities would be running profitable recycling programs.

The northern Ontario town of Kapuskasing has a blue box program that collects cans, glass bottles and used newspapers. The newspapers are baled and transported 489 km to a paper recycling plant in Sturgeon Falls. Aluminum cans must be transported over 1,000 km to the aluminum recycling plant in Oswego, New York; and markets for glass are limited. For Kapuskasing and other isolated towns, the cost of the blue box program is greater than the cost of simply landfilling or incinerating the material. For these communities, recycling serves neither their economic nor environmental best interests. Indeed, Ontario's mandatory province-wide blue box program is in conflict with the federal government's concept of sustainable development, where decision-making is based on an analysis of economic, social and environmental considerations. In Ontario's November 1995 budget, cuts in funds for MSW management were announced and it was suggested that municipalities might consider establishing a user-fee system for waste collection, which should make recycling costs transparent. In turn, local MSW managers should be encouraged to devise new, more cost-effective, means of complying with mandatory recycling regulations. In some towns, curb-side pick-up may cease in favour of voluntary citizen drop-off of recyclable materials at regional recycling depots. This cost-cutting action has already been taken by MSW managers in Kelowna, B.C.

ENERGY FROM WASTE

New incinerators are designed not only to burn waste, but also to recover and use the released energy. Plants are now equipped with high-temperature furnaces, scrubbers and other state-of-the-art pollution abatement systems. Combustible refuse is burned to produce steam for generating electricity, space heating, or for use in a number of industrial processes. The garbage is sorted to remove non-combustible materials or materials with a high moisture content. The remaining combustible fraction is primarily composed of paper, cardboard, plastics, wood, and rubber. Fossil fuels are the raw materials used in much of the manufacture of both plastics and tires; accordingly, these wastes possess a very high-energy value. On a weight basis, the energy content of scrap rubber is 15 to 20% greater than that of coal; capturing the energy from tires releases fewer contaminants per unit energy than burning coal at thermoelectric generating stations.(6)

In Canada, the future for new energy-from-waste incinerators is not very promising. In the recent past, garbage incinerators lacked pollution control devices and were significant sources of atmospheric pollution. Thus, today, any form of waste incineration is suspect in the eyes of the general population. State-of-the-art incinerators are extremely expensive, costing up to $650 million to build. Also, they produce an ash, which, contaminated with dioxins and various heavy metals, is classified as hazardous waste and must be disposed of in expensive, high-technology, chemically-secure landfills. Finally, incinerators and large-scale recycling programs compete for paper, plastic and other recyclables with high heating value. In urban Canada, where recycling programs are already well established and showing an environmental and economic advantage, there is little likelihood that incineration would be proposed by MSW managers or accepted by taxpayers. On the other hand, incineration must not be dismissed; in specific circumstances it is still the most sensible waste management option. For example, the energy content of used tires allows cement kilns to offset their consumption of coal without compromising environmental quality. As previously mentioned, the Ontario town of Kirkland Lake generates electricity by the incineration of waste largely composed of wood debris.

LANDFILLS

Strong public opposition thwarts the establishment of new landfill sites, particularly when a regional or "mega-dump" is proposed. Landfill sites that are properly located, constructed, operated and monitored pose virtually no health risk and cause only minimal diminishment of aesthetic environmental quality. Unfortunately, these landfills are very expensive and usually become feasible only through the economy-of-scale provided by large regional facilities. In essence, with respect to health, safety, and the maintenance of environmental quality, bigger in this case is better.

Many of the materials deposited in a landfill, such as plastics and concrete, bricks and gypsum in demolition debris, are inert; however, organic matter (paper, garden clippings, wood, food wastes) mixes with rain water and is slowly biologically degraded to a liquid waste called leachate, which contains primarily organic acids and dissolved salts and metal ions. Leachate containing organic acids, such as acetic, propionic, butyric, and lactic acids, may leak out of a landfill and contaminate ground water. A low concentration of these acids can give water an off-flavour but is not toxic. The major concern is that metals, such as cadmium, chromium, copper, lead and zinc, can become solubilized in acidic leachate, resulting in potential heavy metal contamination of ground water supplies.

In a properly constructed landfill, leachate collects at the bottom of the pit where further biological degradation converts the organic acids to methane, carbon dioxide and hydrogen gases. Carbon dioxide is inert and hydrogen is generally present at very low concentration; however, methane, unless it seeps up and out of the landfill, may pose a problem. For example, methane may become trapped and

seep laterally through the earth creating an explosion hazard if it collects in the basements of nearby buildings. Accordingly, it is essential that landfills be properly constructed in order that they not pose a risk to people, animals and property.

The prime selection criteria for new landfill sites involve distance from nearest buildings, soil composition and hydrological conditions. Generally a low water table and a site with a clay under-pan barrier 4-feet thick are considered ideal. Alternatively, landfills may be constructed with a double lining of thick plastic along the bottom of the pit, which is contoured so that leachate collects in a central pool. From here, the leachate can be pumped out and put through a conventional waste-water treatment process. The treated water may then either be released over the garbage to wetten and hasten biodegradation, or discharged into municipal sewers. When sections of a landfill become full, venting pipes are drilled into the refuse mass to allow the escape of methane. Upon decommissioning, a landfill is capped with a layer of soil and the methane may be collected and flared; in the case of very large landfills, it is common practice to collect the methane and pipe it to an industrial facility for the production of process steam or electricity.

Access to modern landfills is monitored to ensure that only non-hazardous MSW is tipped. Citizens are encouraged to practise recycling, and to separate hazardous materials from their garbage for special collections or for drop off at hazardous waste collection sites. To maximize landfill space MSW is compacted; at the end of each day, the refuse is sprinkled with a layer of soil to suppress odours, discourage vermin and hasten biodegradation through the introduction of soil microorganisms. During dry periods, the facility may be sprayed with water to contain wind-blown dust. Water from a system of wells around the circumference of the landfill is routinely collected and submitted to biological and chemical testing to ensure its safety.

In many decommissioned landfill sites, the rounded soil cap apparently diverts rainfall away from the refuse below, thus greatly retarding the rate of garbage decomposition. This is not necessarily bad, for it means that refuse buried over 40 years ago may still be intact and retain much of its original value in the form of energy, fibre or mineral content. As a result, some have proposed landfill mining, whereby the landfill would be opened up, the refuse sorted, and all materials of value recovered. Depending upon market stability and demand, landfill mining might be able to pay for itself, and the action could reopen valuable landfill space and provide the opportunity to install landfill liners and leachate collectors.

Landfills remain the least desirable waste management option; however, there will be a continuing need for these facilities as long as materials are generated that cannot be re-used, recycled, composted or incinerated. It will be the continuing responsibility of MSW managers to operate landfills in a safe and environmentally acceptable manner, encourage waste diversion, and participate in an ongoing

planning process to ensure that an adequate supply of landfill space is available.

FUTURE DIRECTIONS IN MSW MANAGEMENT

In Canada, waste management concepts tend to follow one of two philosophies. On the one hand, there is support for government leadership in setting and enforcing strong waste management regulations. On the other hand, there is evolving and strengthening support for a deregulated system in which the actual environmental and economic costs of waste disposal are allowed to drive waste management decisions.

A. The Ontario Experience

Ontario's mandatory blue box program is an example of MSW management driven by government policy. It cannot be denied that Ontario's blue box program has been a success in urban areas, where it now has the potential to divert recyclable materials from landfills at a cost saving to the taxpayer. The decision-makers did not, however, consider the economic and environmental burden this program would represent for small isolated towns that previously managed MSW at much lower cost. The program also had the effect of promoting recycling at the expense of more environmentally friendly alternatives. Indeed, it can be argued that promoting the blue box program as environmentally correct, while hiding its true costs in property taxes, has actually had the effect of increasing the production of single-use packaging materials.

B. The German Experience

The German government has demonstrated strong leadership in regulating MSW management. In 1991, Germany enacted the *Ordinance on the Avoidance of Packaging Waste*, a law that requires manufacturers, distributors and retailers to take full responsibility for their packaging. Under this law, manufacturers and distributors must take back all packaging used in product transportation, and retailers must take back all secondary packaging; for example, the box around a tube of toothpaste. The ordinance specified interim recycling rates for 1993 for seven types of packaging and set the July 1995 collection rate for these materials at 80%. In order to comply with this law, approximately 600 businesses in the distribution chain established an independent company, Duales System Deutschland (DSD), to manage packaging waste. Each participating business pays DSD a fee, according to packaging type, which entitles the company to place a green dot on the packaging material to be collected, sorted and arranged for recycling by DSD.

This system of waste packaging management, which appears to respond to the popular "polluter-pay" principle, has received praise from many quarters and has been described as a model for other countries. The system has one tremendous disadvantage, however: its enormous cost. While Ottawa-Carleton's blue box

program costs $172 per tonne, the DSD program costs over $603.(7) Whether the German manufacturer absorbs green-dot fees or passes them on to the consumer, this financial burden puts the manufacturer at a competitive disadvantage in relation to foreign producers who are not subject to German law. Further, Germany cannot ban foreign products or demand that foreign manufacturers participate in the green-dot system as such action would be deemed an unfair trade restriction.

In Germany, the cost of residential garbage collection is not hidden in property taxes. Homeowners pay a set fee for one garbage container and must pay surplus fees for any extra garbage. German citizens have enthusiastically returned packaging materials to DSD collection bins, with the result that green-dot recycling rates are well in excess of those mandated by law. Germany does not yet have the recycling capacity to handle all the packaging waste; this, in turn, has caused a severe distortion of waste material markets in Germany and in neighbouring countries where German packaging wastes are being dumped.(8) The situation became so acute that, in December 1994, the Parliament of the European Union passed the *Packaging and Packaging Waste Directive* which supersedes German national law and requires the 15 member states to recycle at least 25% of packaging waste, but not more than 45%, by the year 2000.(9)

C. Deregulated Waste Management

The theory behind deregulated waste management is that market and environmental costs can be determined and used to drive a system of waste management that is efficient, economical and minimally harmful to the environment. The first step is to remove the cost of garbage disposal from municipal taxes and to require each household to pay a graduated fee for waste removal in accordance with the waste management hierarchy. The highest fee is paid for refuse going to the landfill, and there is a surcharge for more than one unit of refuse per week. There is a lower levy for each container of material destined for recycling. Thus, there is a financial incentive for the householder to divert as much material as possible from the landfill, and also an incentive to limit the volume of materials for recycling. Such a system encourages "at-home" composting of vegetative wastes, the donation of re-usable materials to charitable organizations and, of most importance, greater participation in return-for-deposit re-use schemes.

Such a system is not without its disadvantages. It is difficult to apply to apartment dwellers, particularly those who rent; it provides a greater inducement to dump illegally; it is more labour intensive, as each household must be directly charged for waste removal; and it may require greater enforcement of anti-dumping regulations. In spite of these drawbacks, this system is beginning to be used in a number of jurisdictions, primarily in Europe and some test cities in the United States. For example, Seattle has a direct charge per bag and a surcharge for additional bags of landfill garbage. No charge is levied for recyclable materials,

however, as it is feared this might discourage early recycling efforts.

DISCUSSION

From World War II to the mid-1980s, Canadian MSW management has meant essentially one thing, disposal in a landfill. Rapidly filling landfill sites, coupled with strong public resistance to the establishment of new ones, has necessitated a change in waste management thinking. While recycling enjoys high public approval, it is unlikely that mandated recycling will offer anything more than a one-dimensional solution. Indeed, recycling promoted without full consideration of the economic and environmental implications may hinder the growth of more worthwhile MSW management options. The long-term answer to the successful management of MSW will most likely be an integrated system that recognizes the value of informed consumer choice; green product and packaging design; re-use, recycling, and waste-to-energy incineration of materials; and the continuing need for landfills. "Finding a way to use full-cost pricing so that decisions are decentralized and quickly adaptable will be the key to achieving thoughtful use of resources and improvements in environmental quality."(10)

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(1) S. Fairlie, "Long Distance, Short Life, Why Big Business Favours Recycling," *The Ecologist*, Vol. 22, 1992, p. 276-283.

(2) B. Reguly, "Blue Boxes: Why They Don't Work," *Financial Times of Canada*, Vol. 80, 3 February 1992, p. 1,4.

(3) *Ibid.*

(4) C. Hendrickson, *et al.*, "Time to Dump Recycling?," *Issues in Science and Technology*, Vol. 11, 1995, p. 79-84.

(5) Conversion factor $1 US = $1.30 CDN

(6) Manitoba Department of Environment, Waste Reduction and Prevention Branch, *Report of the Waste Reduction and Prevention Committee on Used Tires*, April 1991, p. 5-7.

(7) C. Boerner and K. Chilton, "False Economy: The Folly of Demand-Side Recycling," *Environment*, Vol. 36, 1994, p. 6-33.

(8) J. Rose, "New European Recycling Rules to Curb German Efforts," *Environmental Science and Technology*, Vol. 29, 1995, p. 74A.

(9) *Ibid.*

(10) Hendrickson (1995).

/ Trash Troubles

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Trash Troubles

Programs like the blue box may have lulled Ontarians into believing they're doing all they can to help the environment and reduce waste. But Trash Troubles — a Metroland Special Report — shows we aren't being as diligent as we think.

First in a Three-Part Series
By Don Campbell and Thana Dharmarajah

Bob Beacock ignores the overpowering stench. He walks into a pile of sticky, torn garbage bags dumped on top of one of Ontario's heaping landfill sites. Dozens of seagulls snap up morsels of trash as Beacock unearths an umbrella, electrical wires, a plastic Canola oil container and a 20-litre plastic pail. He scoops up a battery with his shovel.

"There's a real no-no," says the Brock Township landfill operator. "I don't know how many times we tell the public. There's one thing I hate seeing in a landfill is any battery." These items could have been diverted through one of Ontario's provincewide waste diversion programs. But they ended up here.

Programs like the blue box may have lulled Ontarians into believing they're doing all they can to help the environment and reduce waste. But Trash Troubles — a Metroland Special Report — shows we aren't being as diligent as we think.

Provincewide, 55 per cent of garbage that could be recycled ends up in landfills instead. As a result, landfills are filling up fast and we are on the brink of a waste disposal crisis, the Association of Municipalities of Ontario says.

"Our garbage continues to outstrip available landfill space," said AMO's president Gary McNamara. "We must either reduce our waste and recycle more waste, or accept new landfills or incinerators in our communities."

Government established ambitious waste diversion targets during the last decade, but today, more than half of the 5 million tonnes of waste picked up at Ontario curbsides annually gets dumped instead of recycled or reused. That 2.7 million tonnes of waste that could have been diverted is equivalent to the weight of 6,222 Boeing 747 jets.

For example, three-quarters of plastics that should be recycled end up in landfills instead.

And even though organics make up about one-third of the province's waste, only 40

per cent of Ontarians have access to a curbside green bin program.

More than $320 million was spent on waste diversion in Ontario last year, through programs funded by industry, municipalities and the province. Consumers also pay through eco fees on certain products.

The results of these programs are poor. Not a single community surveyed for Trash Troubles, this Metroland Special Report, has hit its waste-diversion goal. (SEE CHART)

Ontario towns and cities have made barely a dent in the truckloads of plastic bottles, pop cans, magazines, milk cartons and other household garbage that still end up in dumps. A 2010 report by Ontario's Auditor General ranked the province sixth in Canada by waste-diversion rate, behind Nova Scotia, Prince Edward Island, New Brunswick, British Columbia and Quebec and well behind most European countries.

"There's a good portion of the population who are very devout, who take a lot of time and sort," Beacock said at the Brock Township site, northeast of Toronto. "The rest of them do nothing. It's just all wham bam in a bag and out to the curb.

The same items Beacock is pulling out of the Brock dump are cramming municipal landfills across Ontario, contributing to the crisis that worries AMO. Landfills are running out of space or already full. Brock Township will run out of space in two years. Landfills in at least six other municipalities, including Simcoe County, Northumberland and Muskoka, will fill up within 10 years.

Brock is fortunate: a new incinerator to replace all Durham Region's landfills should be open in 2014. In the meantime, garbage is diverted from full landfills in the rest of the region to a private landfill in upstate New York.

Other communities are scouring for solutions. Some are planning landfill expansions. Those with landfills already closed, including Guelph and Peel, are trucking garbage to other cities in Ontario.

Even green bin waste is a problem. York is sending some of its organics to Massachusetts because its Ontario contractor cannot handle the region's full volume.

There are five major residential diversion programs in Ontario

° Blue Box Waste *(paper, plastic bottles, aluminum cans)*

° Municipal Hazardous or Special Waste *(paints, oil filters, dry-cell batteries)*

° Waste Electrical and Electronic Equipment *(computers, televisions, cellphones)*

° Used Tires *(cars, motorcycles, trucks, buses, trailers)*

° Bottle Deposit Return program *(wine, spirit and beer bottles)*

Many Ontarians may believe that Toronto"s decision to stop sending the city's residential waste to Michigan at the end of 2010 signalled the end of Ontario garbage exports. But the practice continues.

Napanee's waste is trucked to New York State after the community's landfill closed in June.

Durham had been sending the majority of its waste to Michigan since 2002 because of landfill closures. It switched its contract to Model City, New York in January, while awaiting completion of the new Durham York Energy from Waste Facility, an incinerator.

Owen Sound and Meaford have been sending some waste to Michigan since 2005.

Trucks from WeCare Organics, a compost in Marlborough, Mass., have been travelling north to York Region since the summer of 2010 to haul the wet waste back to the U.S. Guelph had been sending its organics to an incinerator in Niagara Falls, N.Y. since 2006 but finally opened a new composting facility in September.

"As long as you have got this escape valve of (sending it south), no one is going to take this issue seriously," said Municipal Waste Association spokesperson Ben Bennett. Municipalities are trying to send less to landfill but falling short of official targets (see chart). Waterloo Region and Northumberland County have not even set a target.

The Auditor-General says waste diversion rates are lagging because:

- Municipalities with enough landfill space are unlikely to reduce curbside pickups and impose garbage bag limits.
- Municipalities have to compete with each other and the private sector to sell their recyclable and compostable materials.
- Municipalities say the nearly $80 million provided by industry for their share of the $160-million-a-year blue box program is not enough.
- They also say it is 40 per cent cheaper to landfill materials that could be recycled.
- Even the types of materials collected in residential blue bin programs differ by municipality.
- While one may accept aluminum foil, trays and take out containers, another may only take one of these materials or refuse it all.

"You go to cottage country and it's different," said Trevor Barton, Peel Region's waste management planning supervisor. "You go to your neighbouring municipality and it's different. It's very frustrating for residents."

Each municipality has to be able to find a market or a solution for the recyclable materials it collects, said Lucy Robinson of the Recycling Council of Ontario. "If there is an inherent value in a product or material, somebody is going to want to use it and therefore, there will be a recycling opportunity."

For example, much of the plastic packaging that ends up in landfills is not included in municipal blue box programs because there's no market for it, she said.

Ontario households trashed 176,500 tonnes of plastics, 116,000 tonnes of printed paper and 122,000 tonnes of paper packaging in 2009, according to a report by Stewardship Ontario, the industry funded organization for the blue box program.

The Auditor-General says the result is that one in five municipalities report they don't have enough space to dump their residential garbage. Not many landfills are being built since it's a long, complicated ordeal to get ministry approval.

Lafleche Environmental Inc. in Moose Creek, near Ottawa, was the last new landfill approved in 1999 in Ontario, the ministry of the environment said. With landfills tough to build, there is a push to keep waste out, spawning provincewide stewardship programs. Experts also say government needs to push producers to design more recyclable and reusable products, also known as extended producer responsibility.

AMO recently ran ads saying consumers and producers of waste should be funding recycling programs so property taxpayers are not left footing the bill.

"A senior on a fixed income who doesn't drive, own an iPad or a big flat screen TV shouldn't have to pay for the high disposal costs of other people's tires, smart phones and computers through her property taxes," said McNamara.

Along with industry involvement, waste management officials and experts say residents need to watch what they are throwing out.

"They would just rather throw it in a bag and get rid of it and throw it in a landfill," said Peterborough's waste management co-ordinator Craig Simmons. "They just think there's an unlimited area where that material can go."

Garbage in Ontario is a mess

Second in a Three-Part Series
By Don Campbell and Thana Dharmarajah

Durham and York are building a controversial incinerator to burn 140,000 tonnes of garbage a year.

Guelph is just getting a handle on its wet waste again with its new compost facility for green bin garbage.

Simcoe County - a community that attracts vacationers and retirees — faces a dire situation with less than six years of life left for three of its four landfills.

Communities are flailing as they try to manage waste within their own borders. Some are already sending garbage out of town. Some are still working on setting waste diversion targets. Others are revising them. And some like the Region of Waterloo don't have waste diversion targets at all.

At least six communities surveyed by Metroland (for this Special Report on provincewide Trash Troubles) have landfills that will run out of space within 10 years. The mountains of trash that Ontarians are throwing into the garbage instead of their blue boxes are forcing other communities to try to find more space in their already bulging landfills.

But the Metroland report shows new landfills are difficult to build because government of Ontario approvals required to create new facilities are hard to get, lengthy and costly.

"You can spend six, seven, eight years preparing and not get an approval at the end of the day," said Adam Chamberlain, a Toronto environmental lawyer. "Approving a landfill in Ontario is not for the faint of heart."

In fact, the Ministry of Environment hasn't approved a single new landfill site since 1999. During that time 147 small landfills have closed, leaving Ontario with 958 existing active landfills. But many of those are small and not classified as capable of taking on a major municipality's trash.

About 85 per cent of Ontario's waste goes to only 32 Ontario landfills classified by the ministry as "large."

The main reason trash is creating problems is that municipal landfills are filling up with garbage that should be recycled or reused, including cardboard, plastic bottles, milk cartons and paper.

The biggest offender is plastic.

A report by Stewardship Ontario shows that about 176,500 tonnes of plastics - including 30,906 tonnes of plastic bottles — were chucked into the garbage instead of the recycling box in 2009, the last year for which provincewide figures are available. That means three-quarters of all that plastic — including 44 per cent of plastic bottles — ends up in landfills.

Another culprit is paper packaging, the cardboard boxes and milk and juice containers that could be recycled as well. About 34 per cent of that material, or

122,396 tonnes, ends up in landfills too.

One Ontario landfill operator, Bob Beacock, regularly spots these recyclable items as they tumble out of the garbage trucks at the Brock site — east of Toronto. But he only has time to rescue the odd scrap metal or tire.

"We can't just get out of the machine and start picking out pop cans," the Brock site operator said. "You just know you'd be here 16 hours a day. That's the public's obligation."

Municipalities say residents are still struggling to divert more waste.

Waterloo Region started a green bin pilot program in 2006, with all households participating by last fall. But the region finds residents still throw organics into the garbage.

"People realize that if your pizza boxes are greasy, it shouldn't go into the blue box but they haven't quite made the connection that it can go in the green bin," said Cari Howard, project manager for the Region of Waterloo's Waste Management Division.

In Toronto, residents are cautious about what they throw into the garbage because of a user fee, said city spokesperson Patricia Barrett. Each resident gets two free garbage tags a year to put out extra trash, but additional tags cost $3.10 each.

But Toronto's waste-diversion rate is still low at about 47 per cent.

Ontario's un-diverted waste is aggravating landfill problems across the province.

Lafleche Environmental Inc. near Moose Creek in Ottawa was the last new landfill approved in 1999, the ministry of the environment said. It was created on a former wetland about 70 km southeast of the capital.

Small landfills are closing up as smaller towns and cities find it cheaper and hassle-free to pay a private landfill or another municipality to take their waste, said Chamberlain, the Toronto lawyer.

The Ontario municipalities whose landfills will overflow within 10 years include Simcoe County.

Simcoe County threw up its hands in 2009 after battling public opposition for 20 years over a new landfill called Site 41. Now six years are left at three of its sites. Staff are considering re-opening two older landfills with some space left, exporting waste outside the county and working with neighbouring municipalities.

Durham Region is building a heavily protested incinerator to replace landfilling, and is currently sending most waste to Model City, N.Y. Its last landfill, Brock, will be out of space in two years, but Durham expects its incinerator to be open by then.

Many communities cannot afford to build an incinerator. They are simply trying to create more space within the landfills they own, despite opposition from environmentalists.

Niagara Region wants to expand Welland's Humberstone Landfill so it is able to accept waste for about 25 more years. Right now, it will be at capacity in 2016. It is currently undergoing an environmental assessment expected to last about three years.

Humberstone sits 12 metres above ground and the plan is to heighten it by six metres.

"It is really about financial sustainability," said Andy Pollock, Niagara's director of waste management services.

He said that if Humberstone is expanded, Niagara taxpayers will save about $18 million over 20 years. Pollock said the expansion means the region would not have to pay to ship the trash to a private facility.

Despite the financial burden, Peterborough may choose to go through landfill expansion again, said Craig Simmons, Peterborough's co-ordinator of waste operations.

There was an expansion approved in 2004, which will keep the northern portion of the Peterborough landfill open for another 17 years. The southern portion closes next summer. "In the long run, it was a better option to proceed with the landfill approvals instead of having to depend upon transferring the waste and being held ransom for unexpected increases in the cost of transporting the waste

out of province," Simmons said.

Kawartha Lakes is one of the luckier municipalities. It has five landfills, although one will be full in two years. For the next 28 years, the community will have space for its trash.

Other communities are not as fortunate.

Both of Northumberland county's landfills will be full in five years. The county has started an environmental assessment to expand its Brighton landfill for 11 more years. During that time it is working on a 25-year waste management plan.

In Muskoka, two landfills are set to close within six years: Gravenhurst and Stisted landfills. But the community got an approval in 2009 to expand its Bracebridge site. It only had four years left, but now it can function until 2035. Muskoka expects Bracebridge will be the only landfill to handle all of its waste.

Environment Commissioner Gord Miller has expressed concern about the Ministry of Environment's oversight as landfills close.

In his 2010 report, called Aging Landfills: Ontario's Forgotten Polluters, Miller said that the aging landfills are not adequately inventoried or regularly inspected, and their approvals are not being updated by the province.

Miller also said the ministry has lost track of hundreds of aging landfills that threaten Ontario's water and air quality.

An inquiry by Metroland into how many of Ontario's 1,325 closed landfills have shut down in the last 10 years took ministry officials two weeks to determine.

Ministry officials said there is no central database with up-to-date records, and that they were not able to answer the question until calls had gone out to the ministry's 22 district and area offices.

Peter Tabuns, the NDP environment critic in the last legislature, said the ministry "is under-resourced and doesn't seem to have the comprehensive record-keeping or inspection that we need."

Conservative MPP Toby Barrett worried about the ministry's overall monitoring ability since leaching into groundwater is more significant with older landfills.

Overflowing landfills also have caused some municipalities to seek cross-border solutions for disposal of their trash.

The municipalities of Peel, Durham, York and Toronto, which have exhausted their waste sites, used to truck garbage to Michigan, an agreement that ended by December, 2010. But other towns and cities still send their trash across the border.

Some municipalities are finding other states to take their garbage and organics.

Durham and Napanee are shipping waste to New York. Durham says it is a temporary solution until its incinerator opens in 2014. Napanee's garbage goes to New York after its landfill closed in June.

Guelph's wet waste went to an incinerator in Niagara Falls, New York since its old composter shut down in 2006. It just opened a new organics plant in September and is no longer sending organics cross-border.

Some of York's organics also head to a compost facility in Marlborough, Massachusetts, because the region's Ontario contractor cannot handle all the

green bin waste.

Toronto bought the Green Lane landfill, near St. Thomas in 2007 and since January, all of Toronto's trash is disposed in the site. Guelph also sends its garbage there. York has a contract to use Green Lane for emergencies, while it sends most of its trash to a landfill in Niagara Falls.

Seeking U.S. answers for municipal waste is not the best solution, said Rob Cook, Ontario Waste Management Association's CEO.

Ontarians should be self-sufficient, he said, and municipalities are handing over about $80 million to American landfills that could have gone to Ontario businesses.

There are also concerns about the border shutting down to Ontario trash. Cook added that if there are any security issues, we are vulnerable.

For example, after Sept. 11, the border closed for two days and Toronto's trash could not be collected and it backed up the system.

"Managing our waste is a hard service like our wastewater and we certainly wouldn't rely on the U.S. to give us water," he said.

Extended Producer Responsibility (EPR) is something Ontario needs

Third in a Three-Part Series
By Don Campbell and Thana Dharmarajahk

A tattered basketball shoe, a Donald Duck plastic toy, VHS tapes and a championship trophy sit scattered in a sorting room at Canada's largest waste recovery plant.

These are some of the more unusual items that sorters have pulled off the production lines of the Material Recovery Facility (MRF) in Brampton, where Peel Region's residential blue box items arrive to be separated, sorted and bundled.

"If you stand around here long enough you will see all sorts of things," said Peel waste supervisor Kevin Mehlenbacher.

Only about 45 per cent of recyclable items from households across Ontario ever make it to one of these plants. More than half of municipal garbage goes to

landfills instead. Peel sells much of the material that comes to this plant in Brampton to China and the United States, where it is reused in new products like aluminum cans or plastic bottles. The region's total take is roughly $10 million a year.

But if households started recycling more, municipalities could strike deals with a new breed of entrepreneurs who understand that garbage equals dollars.

The North American waste stream contains about $8 to $10 billion worth of valuables, said Wes Muir of Waste Management Canada, a private recycling and disposal company.

A major challenge for municipalities is finding markets for recyclable materials.

"Recycling has been around for three decades, but the problem is that end markets have not been established for many materials," said Muir.

Thirty to 40 per cent of North American recycled materials are going to China, India and South America, where demand is growing. There is a booming market for aluminum cans — which fetch the highest price of all materials — as well as PET and HDPE plastics, Muir said. **(See recycling marks graphic)**

There's a move in the municipal waste sector to find new ways of making money for towns and cities by encouraging companies to tap into the value of what society is throwing away. The more waste a municipality can sell, the less it has to spend of taxpayer dollars to manage garbage. Hopefully consumers would buy in as well, leading to higher recycling rates — relieving the pressure on landfills. In the U.S., for example, Texas-based Terrabon is developing technology that converts organic materials and commercial food wastes into organic salts, which is then made into a high-octane gasoline. They are using what's in our green bins.

What Can Residents Do?

- Prevent contamination in recyclables eg. remove bottle caps, clean containers of residue and separate plastic packaging from cardboard.
- Visit local municipality's website to determine what is recyclable in your community
- Put only non-recyclable and non-organic household waste in your garbage bag
- Find local drop-off depots for household hazardous and special waste, used tires and electronic waste
- Reuse common household items for new purposes eg. Old T-shirt as a rag
- Donate any reusable items to charities

"In a world of diminishing landfill space it's important to find sustainable alternatives in dealing with waste," said Malcolm McNeill, the chief financial officer.

The technology exists only on a demonstration scale, but when commercially ready has the potential to process 800 tonnes of wet waste a day — the type of system that could some day pay to get Ontario's organic waste. The push to view waste as a resource — instead of as a problem — has also seen companies convert trash into new products, a model known as up-cycling.

Toronto-based Therma Green Innovative Foam Technologies uses a byproduct of the manufacturer E.F. Walter Inc. to develop products such as holding ponds for irrigation, synthetic turf, landfill covers and liners as well as green roofs. They

are made in part from the high-density polyethylene foam waste generated by E.F. Walter for a range of industrial products. Therma Green is an example of how waste that's currently being landfilled could be profitably reused.

Other companies are taking regular household consumer waste and flipping it. Terracycle, founded in 2001 by Princeton University freshman Tom Szaky, produces more than 1,500 products ranging from duffel bags made out of old Kool-Aid and Del Monte drink pouches to park benches and tables made from plastic containers. But these industries are in their infancy and municipalities need solutions now. Incineration may be a route more communities are willing to take, said University of Toronto professor Philip Byer.

Only about one per cent of waste in Ontario is incinerated now. The only residential incinerator is the Algonquin Power Energy From Waste Facility in Brampton. The plant burns about 500 tonnes of mostly residential waste and generates 9 megawatts of continuous energy -- enough to power 5,000 to 6,000 homes.

Advocates say incineration is an acceptable solution because it generates energy from material that would otherwise be landfilled. Critics say incinerators cause air pollution and that the most energy efficient materials to burn — such as paper and plastic — are also highly recyclable.

"I am not saying (incineration) is a good idea, but it's maybe something you will see more of," added Byer, whose specialty is municipal waste management. Experts say one of the most important solutions to today's landfill problems is to force manufacturers to create more reusable products, an approach known as

extended producer responsibility (EPR).

"EPR is effectively making what goes into the waste stream the problem of the people who put the products into the market in the first place," said York University environmental studies professor Mark Winfield.

This is done by forcing manufacturers to redesign products so they can be reused or requiring manufacturers and businesses to pay a government imposed fee on hard to recycle products. Winfield said Ontario could legislate EPR policies similar to the European Union, which forced producers to make cars and packaging easier to take apart in pieces that can be reused. But there is no move toward that kind of policy in Ontario at the moment.

Just before the recent provincial election, the Ontario Zero Waste Coalition sent 10 recommendations for Ontario's waste management future to each candidate. The group's top priority was to see politicians develop a coherent reduction strategy.

"Diversion is nice, but the first thing everyone likes to forget is reduction," said coalition founder Liz Benneian.

She said the government is "leery" about even mentioning reduction because of the potential consumer backlash, but added environmental entrepreneurialism could be a boon to the Ontario economy.

"Everyone needs to be honest about the situation," she said. "We are not going to get anywhere with this problem unless we start looking seriously at reduction."