by Clarissa Morawski

"Recent EA suggests a new electricity-only thermal facility will treat waste at a cost of between $102 and $168 per tonne."

The pros and cons of waste to energy — a disposal strategy that's making a comeback

Garbage In, Garbage Out

Municipalities across Canada are enticed by the prospect of what seems to be an elegant solution to their waste disposal problem. Once termed "incineration" or "energy from waste," today the politically correct terminology is "waste to energy" (WTE) or "thermal treatment." After falling out of favor for decades, it's being hailed by many as the optimal solution for our growing waste disposal problem, and a looming energy crisis. In some circles, proponents even suggest that thermally treating waste for energy helps mitigate climate change. York Region (north of Toronto) has announced the short list of preferred sites for a large mass-burn waste incinerator. *(See news item, page 40.)* Consultants for the Niagara-Hamilton "WastePlan" have recommended thermal treatment as the preferred disposal alternative for the 35 per cent of municipal waste that can't easily be recycled or composted.

So why is there resistance to this solution? The disagreement is less about the science and more about philosophy; there's lots of credible third-party data on existing newer generation facilities, but this doesn't square the circle of two very divergent belief systems.

Thermal treatment proponents say that WTE captures a wasted resource by utilizing its calorific content to generate energy (electricity and sometimes also steam) and replace other forms of polluting energy like coal. Some even view garbage as a "renewable resource." Proponents believe it makes no sense to bury the material and its embodied energy in a landfill (which might also produce methane, a potent greenhouse gas).

The opponents' viewpoint requires a little more explanation, but the gist is that they view the issue not as a "disposal" challenge, but rather as a matter of sustainability. Simply making waste "disappear" by burning may partially solve a disposal problem (except the ash which requires landfilling), but it perpetuates the delusion that we can continue consuming natural resources as we do currently. Waste to energy's very success is its problem for them, and they feel that many of the non-recyclable or non-compostable materials that would find their way into a thermal treatment plant shouldn't be produced in the first place. Furthermore, WTE plants may attract some portion of otherwise recyclable materials and reduce the impetus for aggressive waste diversion. (*See news item on PPEC and EMS opposing thermal treatment, page 7.)*

The two opposing viewpoints tend to pit waste companies and engineers against recycling coordinators and activists, with each side feeling the other is biased and even irrational, deluded or self-interested. Policymakers who opt for or oppose thermal treatment inevitably incur the wrath of either side.

Material	Energy savings from Recycling (GJ) tonne	Energy output from Thermal treatment (GJ) tonne	Energy savings from recycling versus thermal treatment
Newsprint	(6.33)	(2.62)	2.4
Fine Paper	(15.87)	(2.23)	7.1
Cardboard	(8.56)	(2.31)	3.7
Other Paper	(9.49)	(2.25)	4.2
HDPE	(64.27)	(6.30)	10.2
PET	(85.16)	(3.22)	26.4
Other Plastic	(52.09)	(4.76)	10.9

Source: *Determination of the Impact of Waste Management Activities on Greenhouse Gas Emissions: 2005 Update Final Report*, ICF Consulting October 31, 2005, submitted to Environment Canada and Natural Resources Canada

The macro perspective

Long term trends may work against thermal treatment in Canada, despite its current level of public support (80 per cent in some polls). The public is becoming highly aware of the threat of man-made climate change and other sustainability challenges. People are hungry for any opportunity to mitigate global warming and the other side-effects of the consumer society that are placing whole ecosystems under stress and, ultimately, in danger of collapse.

It's established that recycling waste results in a significant energy savings as the need to extract primary resources is avoided. The energy gained from thermally treating that waste instead of recycling it is but a fraction of the benefit. (*See charts above and on page 11.)* Maximizing recycling is not simply about saving landfill space; it's about improved energy efficiency and reduced greenhouse gases.

Proponents argue that high recycling and thermal treatment are compatible, but as recycling success moves beyond 60 per cent it will impact the fuel (waste) used in a thermal facility. Increased source separation in the IC&I and construction and demolition sectors and multi-residential dwellings, including organic waste, will all contribute to achieving greater than 60 per cent diversion. If this happens (which many believe is inevitable) the waste stream won't have a high calorific value.

This is not ideology; it's supported by research on the technical and environmental parameters for waste to energy and recycling of house-hold waste published in the *International Journal of Thermal Science* (Volume 43 [2004] 5 19-529), which states that increased recycling "leads to a decrease of energy recovery so that it is necessary to use additional boilers to meet the initial energy demand. The related impacts tend to offset the environmental benefits derived by the waste recycling itself." It continues, "The main drawback of the selective collection of household waste is that it involves a decrease of the energy produced by waste incineration mainly caused by the recovery of paper/cardboard and plastics."

There is certainly some fraction of the waste stream that cannot be recycled or composted economically (the bloody meat wrapper being a popular example), so some kind of disposal will always be necessary until we achieve "zero waste," but before we get to that, some other factors need to be understood.

"Expansions at Greenlane, Walker and Warwick landfills have created about 50 million new tonnes of landfill capacity in Ontario."

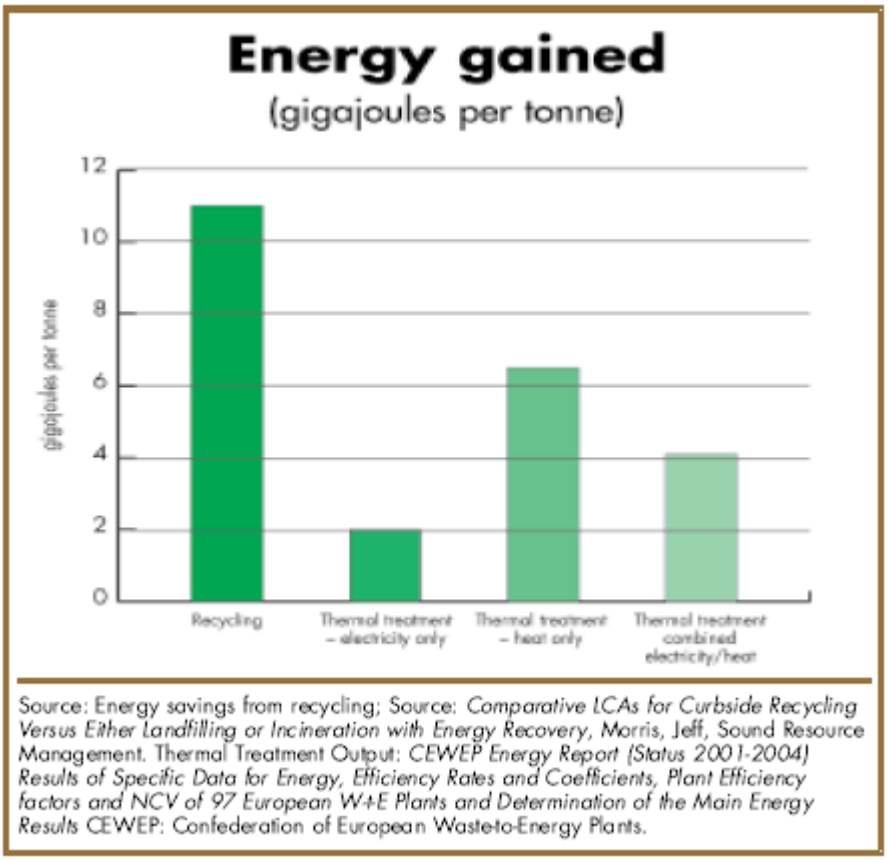
The carbon market, emissions and economics

The global movement to mitigate climate change will soon see the emergence of national and international policies like carbon taxes, emissions trading, etc. all of which will further increase the costs associated with carbon emitting activities. In the case of electricity derived from combustion (massburn) and gasification of household waste, the CO2 emissions on a Kwh basis are more than 30 per cent, and 90 per cent higher than coal respectively; and 56 per cent and 99 per cent higher than steam turbine natural gas respectively. *(See bar charts.)* Aggressive emissions reduction policy in Canada, like the recently announced federal Liberal plan (which suggests a 36 per cent reduction for electricity generators) will make procurement of waste to energy much less attractive than it may be today. Instead, energy customers will turn to hydro, wind, biomass and other more "climate friendly" sources (even nuclear).

It's argued that today's technology is far less polluting due to more sophisticated pollution mitigation equipment (which is true). However, as a society we accept less pollution than we did decades ago. Consider for example, dioxins. Dioxins are persistent and bio-accumulative and are implicated in cardiovascular disease, diabetes, cancer and a host of other conditions that include neurobehavioral and reproductive effects. So dangerous are these toxins that in 2001 Canada was the first nation of 128 to sign on to the Stockholm Convention on Persistent Organic Pollutants (POPs), an international treaty designed to end the production and use of some of the world's most poisonous chemicals. Around the same time, the Canadian Council of Ministers of the Environment (CCME) released Canada-Wide Standards for Dioxins and Furans, which called for virtual elimination under the ***Canadian Environmental Protection Act*** (CEPA). It's widely accepted that thermal treatment of municipal solid waste (more specifically, the combustion of plastics such as vinyl) releases less dioxin than in the past, but dioxin has certainly not been eliminated from the process. In fact, according to the US EPA, gasification — a newer thermal treatment technology — actually releases more dioxin per tonne than traditional mass burn facilities (and treats the waste at a much higher cost).

Another example is heavy metals like mercury. Exposure to mercury can lead to developmental delays, slurred speech, memory loss, difficulty walking, blindness, paralysis, heart disease, kidney failure, liver damage and even death at extreme concentrations. The United Nations estimates that more than one million children worldwide have brain development problems as a result of mercury poisoning.

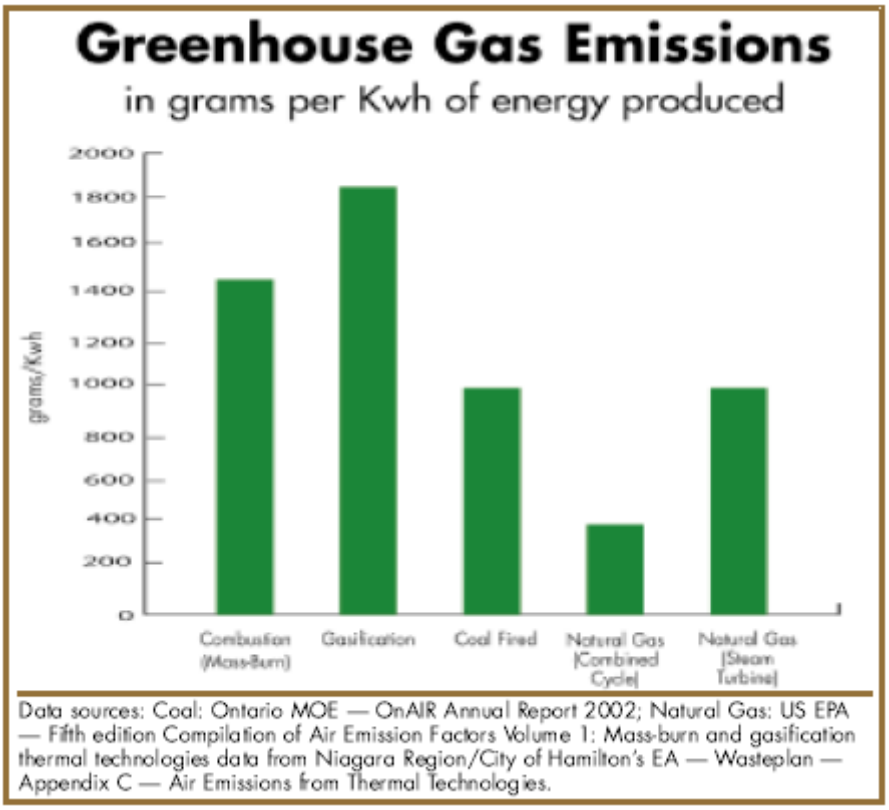
Emission estimates from thermal treatment equipment manufacturers themselves show that mercury released from burning municipal solid waste is about five times higher per Kwh of electricity than coal, and 35 times higher than steam turbine natural gas. Gasification of household waste releases 3.8 times more mercury per Kwh than coal and 27 times more than steam turbine natural gas. Dioxin and mercury are but two examples of the hundreds of toxic emissions from these plants.



Source: Energy savings from recycling; Source: *Comparative LCAs for Curbside Recycling Versus Either Landfilling or Incineration with Energy Recovery*, Morris, Jeff, Sound Resource Management. Thermal Treatment Output: *CEWEP Energy Report (Status 2001-2004) Results of Specific Data for Energy, Efficiency Rates and Coefficients, Plant Efficiency factors and NCV of 97 European W+E Plants and Determination of the Main Energy Results* CEWEP: Confederation of European Waste-to-Energy Plants.

Proponents of thermal treatment often use Western European countries as examples of success, i.e., lower emission profiles. However, these countries are also leaders when it comes to prohibiting toxins in products (which will eventually become waste). They also have producer responsibility laws to ensure that certain products are pulled out of the waste stream. Canada has only limited regulations in place to ensure that toxic substances like mercury are prohibited in products. While some provinces do recover and properly manage end-of-life electronics, special wastes, etc. our largest provinces like Ontario and Quebec are still far away from being able to assure citizens that the waste stream is relatively free of toxins.

And finally — even if you dispute the health risks from thermal treatment plants — an important issue to ratepayers is that



Data sources: Coal: Ontario MOE — OnAIR Annual Report 2002; Natural Gas: US EPA — Fifth edition Compilation of Air Emission Factors Volume 1: Mass-burn and gasification thermal technologies data from Niagara Region/City of Hamilton's EA — Wasteplan — Appendix C — Air Emissions from Thermal Technologies.

incineration is extremely expensive and relies heavily on electricity sales revenue (not guaranteed) to offset the high capital and operating costs. Expensive but necessary pollution abatement equipment, daily operations, natural gas imports to support the process, landfilling costs for the residual ash, and hazardous fly ash all contribute to the big bill associated with thermal treatment. Understandably, costs can vary dramatically depending on capacity and technology, but recent estimates from the EA undertaken for Region of Niagara and City of Hamilton suggest that a new electricity-only thermal treatment facility will cost between $102 and $168 per tonne, with electricity revenues accounting for about 35 per cent of the annual cost off-set. Traditional landfilling with gas recovery ranges from $61 to $89 per tonne, and mechanical and biological treatment with landfilling of stabilized residuals will run between $127 and $180 per tonne. Recent government approvals for expansions at Greenlane, Walker and Warwick landfills have created about 50 million new tonnes of landfill capacity in Ontario, which begs the question: Is thermal treatment even cost competitive?

If we already possess the technology and know how to actively work towards minimal or even zero waste in the future, why would we invest large sums of money in a potentially dangerous technology for small amounts of electricity (usually only enough to power a little over two thousand homes), and a technology which only encourages our current pattern of unsustainable resource consumption and waste generation?

Some countries (e.g., Germany) are now using "stabilized" landfills, where recyclables, organics and specials wastes are pulled out and only inert, stable waste is landfilled (for a much reduced pollution profile). In contrast to thermal facilities that require waste input around the clock, stabilized landfills don't require such feeding to operate, and this supports maximum diversion. Ideally, segregation of certain wastes in such landfills could allow materials mining in future. *(For more on stabilized landfills, see the article on page 16.)*

Policymakers and citizens need to closely compare the costs and benefits of thermal treatment with those of MBT and stabilized landfill before they invest in a disposal strategy for their post-diversion wastes. This is the debate that needs to unfold publicly now in Canada before any large waste-to-energy plants are built.

(Note: Readers are directed to the articles on gasification and stabilized landfill that appear on pages 14 and 16 respectively. Also, the June/July edition will feature the first of a series on mechanical and biological treatment [MBT] of waste.)

Clarissa Morawski is principal of CM Consulting in Peterborough, Ontario. Contact Clarissa at morawski@ca.inter.net