Incineration of Municipal Solid Waste
A reasonable energy option?
Fact Sheet 3

Recently, a significant amount of attention has been paid to incineration of municipal solid waste (also know as energy-from-waste or thermal treatment) not only as a disposal option, but as an energy producer as well. As municipalities develop their waste management plans for the next 20-30 years, it is imperative that they be armed with accurate information to better inform their process.

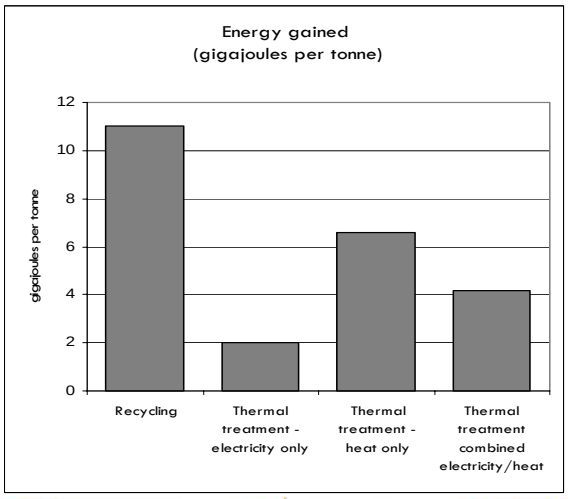
The following fact sheet is intended assist municipal decision makers better comprehend the issues related to municipal solid waste incineration facilities like the energy output; its relation to waste; the relationship to the sale of energy; and selling energy from waste in Ontario.

How efficient is it to burn waste for energy?

Materials that are found in our waste stream, like plastics, paper, tires, woods waste etc. contain carbon, which when combusted produce heat which can be used to create energy (electricity and/or heat). The amount of energy is dependent on a number of variables, including how much non-combustible material is in the stream, how much moisture is in the waste; how efficient the conversion technologies are; and finally if both electricity and heat are being generated.

Recycling these same wastes results in a much greater energy gain, simply by not having to undergo all the energy intensive steps required to extract primary resources used to manufacture the same products. Recent extensive life cycle inventories for Canada compare the energy gained from recycling versus combustion (see chart at right[1]). The results show recycling paper materials saves 2.4 to 7 times the energy gained from combustion, and recycling plastics saves 10 to 26 times the energy gained from combustion alone.

Material	Energy savings from Recycling (GJ/tonne)	Energy output from Incineration (GJ/tonne)	Energy savings from recycling versus Incineration
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



When we look at thermally treating a tonne of mixed waste in a modern incineration electricity facility (in this case data is from the most efficient facilities currently operating in Europe), recycling that same waste would result in about 5.4, 1.6 and 2.6 times the energy savings than incinerating with electricity recovery; heat recovery; or combined electricity and heat recovery respectively. (See graph on left[2]).

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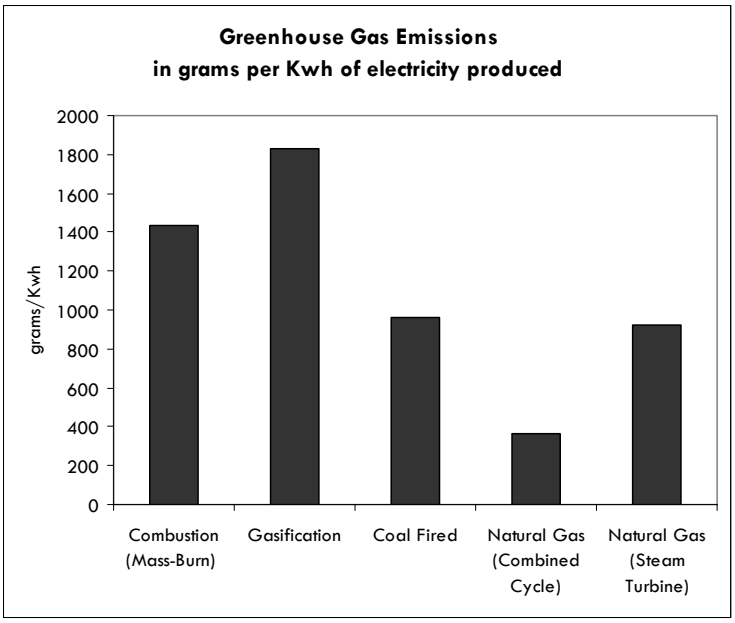
How does energy from waste compare with other energy sources in terms of their impact on global warming?



When we compare energy producing technology used in Ontario, incineration contributes the greatest amount of greenhouse gas emissions.[3] Compared to coal fired technology, mass-burn incineration contributes about 33%, and gasification about 90% more GHG emissions per Kwh of electricity produced.[4] This is especially relevant in the context of Ontario's energy policy. In 2005, the Provincial government announced an aggressive plan to replace coal-fired generation with cleaner sources of energy and conservation. The Minister of Energy at the time stated, "*We are leading the way as the first jurisdiction in North America to put the environment and health of our citizens first by saying 'no' to coal…It's a prudent and responsible path that will ensure cleaner air for the province*."

How easy is it to sell energy from waste in Ontario?

Today the Ontario Power Authority[5] (OPA) has developed a short and long term plan for electricity which does include recovery of energy (methane) from landfills, but no energy from thermally treating municipal waste. Further, the OPA defines "renewable biomass" for energy production as organic matter that "is not municipal solid waste"[6]. Instead, OPA will monitor the feasibility of greater electricity generation from waste, as well as other emerging technologies, going forward and will update future integrated power system plan (IPSP) accordingly. OPA writes, "Incineration or other forms of thermal treatment can be controversial public issues, due to perceptions regarding air emissions, ash, odors.." "Some of these concerns could be alleviated through proactive municipal ordinances and waste diversion programs that remove packaging wastes, household hazardous wastes and other problematic components of municipal solid waste stream". [7] Currently in Ontario, the diversion rate for:

- household packaging waste is only 44% with over 465,000 tonnes of highly recyclable packaging still going to waste[8];
- household hazardous waste is only 36% with over 54,000 tonnes of waste paint, antifreeze, single cell batteries, and solvents going to waste[9]; and
- Information technology, telecom and audio visual equipment waste is only 1% with nearly 70,000 tonnes of obsolete electronics going to waste[10].

Given the above statistics, it is highly improbable that the OPA would consider incineration of municipal solid waste which not only has recyclables, but more important, still contains many toxic substances suitable for combustion.

Without OPA including energy from incineration facilities in the IPSP, municipalities or their operators will be required to initiate energy sales through the Independent Electricity System Operator (IESO) Administered System, which is subject to fluctuating prices (spot market pricing). Otherwise, facility owners must negotiate with the private sector to purchase Kwh and/or heat with short-term or long term contracts.

Does maximizing recycling compromise energy production?

While thermal facilities for waste disposal do exist around the world with varying levels of efficiency, in terms of energy outputs, one thing is certain; gaining efficiencies necessitates that incinerators operate continuously, which demands a steady stream of combustible waste. Disturbing the flow of waste will disrupt the system and its energy output. As Ontario residents continue to strive for diversion beyond 60%, our success will impact the economic viability and efficiency of the thermal facility.

This irony is illustrated in a recent study which analyzed how recycling programs affect incineration. The study showed 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."*

"The main drawback of the selective collection {curbside recycling} 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."[11]

In summary

As we move forward with waste management planning, our efforts and tax dollars should focus on the lowest risk option - improving diversion and maximizing recycling. Recycling instead of burning resources achieves the greatest efficiencies in terms of energy conservation, reduced overall pollution and promotion of renewable and sustainable energy planning in Ontario.

ENDNOTES

[1] *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

[2] Energy savings from recycling; Source: *Comparative LCAs for Curbside Recycling Versus Either Landfilling or Incineration with Energy Recovery,* Morris, Jeff, Sound Resource Management

Energy output from European Countries: *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-t-E Plants andDetermination of the Main Energy Results* CEWEP: Confederation of European Waste-to-Energy Plants, http://www.cewep.com/

[3]Data sources: Coal: Ontario MOE – OnAIR Annual Report 2002; Natural Gas: US EPA – Fifth edition Compilation of Air Emission Factors Volume 1; Mass-burn incineration: data provided for Niagara/Hamilton's Environmental Assessment – Wasteplan. Final draft Report on Comparative Emissions Study, June 2005. The data was provided by 5 potential vendors of incineration technologies.

[4] Ibid.,

[5]Ontario Power Authority or "OPA' has no commercial interest in any specific projects; its sole objective is to plan a system that delivers the best outcome for Ontario consumers based on the policy guidelines it has been given. The OPA's mandate is to undertake a long-term planning function to develop an integrated power system plans to meet Ontario's electricity requirements.

[6]Standard Offer Program – Renewable Energy Program Rules- page 30, www.powerauthority.on.ca/

[7] Discussion Paper 4- Supply Resources, www.powerauthority.on.ca/

[8] Based on data for 2004, Table 1: Generation and Recovery (full-year obligation), Stewardship Ontario.

[9] Draft for Discussion - Handout #2 Municipal Hazardous or Special Waste Plan Development Workshop #2, Stewardship Ontario

[10] Waste Electronic and Electrical Equipment Study, Waste Diversion Ontario, CSR, RIS International Ltd., MacViro Consultants Inc. & Jack Mintz & Associates Inc., 8 July, 2005

[11] Wenisch, Rousseaux, Metivier-Pignon, *Analysis of technical and environmental parameters for waste-to-energy and recycling: household waste case study, October 2003, International Journal of Thermal Sciences , ELSEVIER*