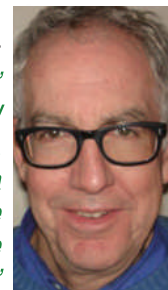


by Rod Muir

*"Incinerators demand a "Put or Pay" agreement that a guaranteed quantity of MSW be delivered or the facility is compensated. As a result, it seems highly unlikely that a municipality is going to strive to further reduce its waste by devoting additional money, time and ideas to increasing diversion."*



# Peeling away the layers from Waste-to-Energy

**I plan now to approach MSW from the opposite direction, specifically the environmental and economic damage wrought by its disposal via incineration**

**W**ith the recent decision to cancel an incineration proposal in Peel Region, the Durham/York Region incinerator one year behind in beginning operations, Plasco Energy seeking creditor protection, and with the defeat of proposals in Brantford, Meaford and Port Hope, and finally Metro Vancouver discontinuing its energy proposal, perhaps it's time to re-examine how much energy is *really* produced by burning municipal solid waste (MSW) and at what environmental and economic cost.

Spoiler alert, as the kids say today; I believe trying to burn municipal solid waste (MSW) to create energy is shockingly inefficient, costly, a net contributor to greenhouse gases (GHGs) and climate change, produces smog and many other emissions, as well as copious amounts of ash, a good portion of which is highly toxic. Finally, incineration diverts money, time and attention from all-important diversion activities.

Normally, I stress the importance of the quick, inexpensive and easy role waste diversion can play in achieving sustainability. Now, I plan now to approach MSW from the opposite direction, specifically the environmental and economic damage wrought by its disposal via incineration.

## The Myth of "Residual" Waste

I always stress that understanding the composition of MSW is the key to finding solutions. Similarly, the composition of so-called "residual" waste, what remains after we have "maximized" diversion, is key to understanding the many shortcomings of solid waste as a fuel source.

I have examined, specifically, the "residual" waste of Durham/York and Peel Regions, as detailed in their respective studies, conducted as part of their efforts to develop incineration facilities. Close to 70% of Durham's "residual" will either not burn, or is recyclable. Metal and glass comprise 17.2%, while foodscraps, pet waste and leaf and yard material combine for 22.4%, and household hazardous waste is at .3%.

It should be noted that diversion rates in Western Europe are similarly mid-range, at approximately 50%. Despite this fact, there are many who suggest that non-existent, higher rates of diversion are proof that incineration must be a more advanced method of disposal than landfill because it's used throughout Europe. I like to call this "The Myth of Europe."

The above information clearly indicates, to me at least, that the notion we have "maximized" diversion requires much closer examination. Furthermore, the ensuing inefficiency of incineration is a direct result of composition — items that will not burn, like metal and glass — or worse still, foodscraps with high water content that consume more energy than they provide. Prove it for yourself. Go home tonight and build a small fire, then throw dinner on it and see how much (heat) energy you get. Take it from me, you'll be both cold and hungry.

## Oh, the inefficiency

A megawatt (MW) certainly sounds like a great deal of energy, doesn't it? Well it's not really. The reality is when you consider a MW in relation to total Household energy use it's barely enough to completely provide for 250-300 homes. As such Durham's new 140,000 ton per annum (TPA) facility, which will produce 14 MW, is enough to supply all the energy needs of about 3,900 homes. Similarly, Peel's planned 250,000 TPA facility was to generate 25 MW suppling just 6,900. By way of comparison there are 403,000 homes and apartments in Peel. Therefore, burning all their residual solid waste will provide power for just 1-2% of these homes. From my research, this rule of thumb is sadly true - burning half the waste of a city, town or county generates just a fraction, 1-2%, of total energy needs.

Why, because solid waste is such a sub-standard fuel source. No wonder Peel Region makes a point of stating in their report "It should be noted that the main objective for energy from waste facilities is to reduce the amount of waste that would otherwise need to be disposed of in a landfill while the production of power is secondary."

The fact is incineration captures only 15-20% of the calorific value of the input waste. An incinerator producing steam, as well as electricity, does somewhat better 25% but you need a year round customer for the steam. The situation is worse still when comparing the embodied energy, what energy that went into making the product, harvesting the raw material(s) manufacturing etc., with only 10-12% of the total embodied energy captured.

It's often said incineration conserves one barrel of oil for every ton that is combusted. What's not said is that eight barrels of oil went into making that ton of waste material in the first place. Or that four barrels of oil could be conserved by diverting that ton of material. Based upon the foregoing it's hard to resist calling incineration a waste of energy rather than waste-to-energy as some do.

And oh, the cost.

Durham's newly built incineration facility cost over \$280,000,000,



\$2,000 per design ton (140,000 TPA) or \$20,000 per kW. In comparison, according to the Energy Information Administration, (www.eia.org) a facility producing electricity from Natural Gas can be built for as little as 1/10 that amount — \$2,000 kW. The gap in Ontario actually is much larger still. The new 280 MW Green Electron Natural Gas plant near Sarnia has a budget of \$360,000,000 or \$1.2MM per MW. Prior to its cancellation the 250,000 TPA Peel incinerator was to cost \$634,000,000 (and climbing). Presuming, 25 MW of energy production that's \$25.4MM per MW 20 times higher than the Green Electron facility.

Operating costs, including most significantly the cost of fuel similarly follows EIA's 1/10 ratio. Roughly \$.02 - \$.03 per kWh for N.G. generation based upon a \$.12 - \$.18 per m3 N.G. cost vs. \$.20 per kWh for incineration based upon a \$120 per ton tip fee.

The truth is incineration's only saving grace is that the fuel source has a negative value. That is to say the sources of the fuel including Municipalities will pay to have this material disposed of. Whereas of course in a N.G. facility the fuel must be paid for.

### Incineration and GHGs

According to the Region of Peel, from a GHG perspective the incineration of MSW produces almost double the GHGs per unit of energy than burning coal and 50 – 100 times more than natural gas. Additionally, incineration releases five times the nitrogen oxides of coal. Why then would we work so hard as the Province of Ontario has to get "Off Coal" only to "Get On To MSW"?

Yes, it's true that landfills are also a significant contributor to GHGs, as they are the largest source of manmade methane (CH<sub>4</sub>) on Earth, primarily the result of foodscrap degrading under anaerobic conditions. But as previously stated, foodscrap are highly detrimental to incineration efficiency and cost, as they consume more energy than they produce. Though perhaps because of their weight, facilities love this material. The point is, we should neither be burning or burying this material, and once foodscrap are removed from the waste stream it's far better to bury what remains than to burn it. You see, by burning plastic and especially all types of paper fiber, you immediately release all of the carbon they contain as GHGs. If on the other hand, you landfill this material, it's now being recognized that you have, in fact, sequestered a good portion of those same GHGs, essential if we are to limited global warming to 1.5 – 2°C

### ... And many other emissions

Before discussing other types of emissions produced from burning waste, it's worth mentioning that according to the European Union there are over 100,000 chemicals in use, of which we have a basic risk assessment for about 25%. Furthermore, to test the co-reactions of only the 1,000 most common chemicals, just in groups of three, would take 160,000,000 experiments and over 180 years! The point being, we sim-

ply have no idea what's going on when we expose these chemicals to high heat alone or in combination with other chemicals.

To continue, I can't argue there have been advances in the atmospheric pollution control systems, with a corresponding and significant increase in the cost of incineration. However, let's be clear, emissions have not been reduced to zero, nor anywhere close to it, and they are still significant in relation to the environmental load we are already placing on our land, air and water.

While Peel's study considered GHGs, it ignored the negative effects on human health and ecosystems of particulate matter (PM), NOX, SOX, mercury, lead, cadmium, toluene, benzene, zinc and vinyl chloride.

I hope it's not too late to remind you that matter can neither be created nor destroyed. Therefore the total weight of waste that goes into an incinerator as either a solid or liquid must leave as either a solid (ash) or a gaseous emissions, as of course, thermal treatment makes the presence of liquid impossible.

Incineration is said to reduce volume by 90% and weight by 70%. With regard to volume it's quite possible that the benefits are overstated. Compaction at landfills is quite high with upwards of a 5/6 reduction in volume compared to what residents initially put out in their garbage can or bag.

**“Prove it to yourself. Go home tonight and build a small fire, then throw dinner on it and see how much (heat) energy you get. Take it from me, you'll be both cold and hungry.”**

Reductions in weight are more accurate but still don't paint a completely accurate picture of this so-called benefit, as landfill tip fees are for the most part based on weight not volume. Furthermore, 20-25% of the ash (8% of the total incinerated) is the highly toxic leftovers of the APC system, which only captures and concentrates the toxins and as such contains various heavy metals including lead, mercury and cadmium and requires disposal in a much more expensive hazardous waste landfill.

### Diverting money, time and ideas from Diversion

Given the high cost and specialized nature of an incinerator, it's extremely common that these facilities demand a "Put or Pay" agreement that a guaranteed quantity of MSW be delivered or the facility is compensated if it's not. As a result, it seems highly unlikely that a municipality is going to strive to further reduce its waste by devoting additional money, time and ideas to increasing diversion.

It's often mentioned that municipalities with incinerators have diversion rates similar to those with landfills. This may be true. But at this point what's required is a doubling (no, tripling!) of our diversion efforts. And after diverting foodscrap, along with everything else, we can improve a landfill we're working hard to send less to, rather than an incinerator to which we are obligated to deliver a steady quantity of "residual" waste. ♻️

*Rod Muir, Hons B. Comm., MBA, is the Waste Diversion and Sustainability Chair for the Sierra Club Canada Foundation. He is willing to talk to any group on this important subject and can be reached at rodmuir@sierraclub.ca or 416-535-9918.*