

Review of U.K. Publication (by Prof. Nickolas J. Themelis, WTERT Chair):

A Changing Climate for Energy from Waste?

Report for Friends of the Earth by Dominic Hogg of Eunomia Consulting

http://www.foe.co.uk/resource/reports/changing_climate.pdf

News report on above: “Waste-to-energy not climate friendly, research shows (4 May 2006)

http://www.edie.net/news/news_story.asp?id=11395&channel=0

Review of Eunomia Report by Nickolas Themelis, Director, Earth Engineering Center

This is a well written report carefully prepared to present a particular point of view.

- a) First, a lot of effort has been put in the report on the known fact that municipal solid wastes (MSW) are not as good a fuel as fossil fuels. To this effect, the authors have even downplayed the amount of energy generated per ton of MSW to WTE facilities, which they reported to be 250 kWh/metric ton of municipal solid wastes. In fact, the U.S. WTEs generate, according to DOE, 13.55 billion kWh of net electricity plus 0.165 billion kWh of heat. For the 28.9 million tons of MSW combusted in WTEs, the average generation is 500 kWh per short ton of 550 kWh per metric ton. European WTEs recover even more energy because of the use of WTE energy for district heating. The recent CEWEP (www.cewep.com) study of 97 European WTEs showed that their average energy generation was 302 kWh of net electricity plus 878 kWh of net thermal energy per metric ton of MSW. Therefore, the authors start with an estimate of energy generation that is wrong by a factor of four.
- b) The bias of the report is shown clearly in Table 8 of this report (see below) where the air pollutants compared do not include the major pollutants of landfilling: Methane, mercaptans, ammonia, and various chlorinated compounds that have been tabulated by Tchobanoglous et al in the Handbook of Integrated Waste Management, as well as in several WTERT (www.columbia.edu/cu/wtert) and other published reports. The report also does not mention the emissions of Waste Transfer Stations and diesel trucks that are needed to transport MSW to the distant places where landfills are usually located.
- c) In particular, the authors do not present an estimate of the expected generation and capture of methane per tonne of MSW landfilled. In fact, landfilling of U.K. MSW generates in the first year after deposition about 80 standard cubic meters of methane, or 57 kilograms of methane per tonne of MSW. Since the Intergovernmental Panel on Climate Change (IPCC) has estimated that 1 volume of methane has the greenhouse effect of 23 volumes of carbon dioxide, the equivalent tonnage of carbon dioxide is 3.6 metric tonnes per tonne of MSW. Landfills that are equipped for methane capture at the most can capture 60% of the emitted methane. A recent WTERT study showed that globally only 10% of the methane generating landfills are equipped for LFG capture. A conservative comparison of greenhouse gas emissions has shown a minimum saving of 1.3

tonnes of carbon dioxide per ton of MSW combusted rather than landfilled in landfills equipped for carbon capture.

- d) Once again, the specious argument is presented that it is better to recycle plastic wastes and not combust them. This is absolutely true but the plastics ended up in the MSW because there were no people and markets eager to sort them out of the MSW. In the U.S. only 10% of the plastic wastes are recycled and another 8% are combusted in WTEs. Therefore, the WTEs that combust plastics do not snatch them away from **recycling** but from **landfilling**. If the authors of this report had taken into account this basic fact, they would have properly compared the efficiency of energy recovery from plastics going to WTEs and to landfills.
- e) In opposing WTE and thus encouraging the perpetuation of landfills, concerned environmentalists make a strategic error: As long as there are landfills – a means of disposal that is much less costly than WTEs – there will be less incentive for people to recycle. They are shooting themselves in the foot.
- f) Interesting note in the report that was not controversial enough to be included in press reports of the report: *"None of this is to imply that 'energy from waste' has no role to play in managing solid wastes (4 May 2006)*

Table 8: Unit Damage Costs Used / Derived in Different Studies

Pollutant	Enviros and EFTEC (2004)		EU-CAFÉ (2005)	
	Low	High	Low	High
PM (landfill)	161	1,025	24,667	73,333
PM (incineration)	6,119	39,425		
SOx	643	2,941	4,400	12,667
NOx	154	977	2,600	6,667
VOCs	263	665	759	2207

"... there is very little by way of field measurements to substantiate the use of the high gas captures being posited in Defra studies over the lifetime of the landfill (and hence, over the period during which gases are being emitted from a tonne of waste in the landfill). Instantaneous gas capture rates may reach, even exceed, 50%, but instantaneous rates are certainly not the same as lifetime rates. Dutch field measurements give figures between 10-55% for instantaneous gas capture rates, and average rates of around 25%, whilst default figures for reporting to IPCC are likely to be specified at around 20%.²¹ A forthcoming report in the US, co-authored by one of the early installers of landfill gas capture systems there, suggests the amount captured over the landfill's lifetime is likely to be around 19%.²²"

These plastics (within a tonne of residual waste) are estimated to contain 59kg of carbon. Their combustion would therefore release around 217kg CO₂, all non-biogenic, into the atmosphere. It

is quite clear that only if the efficiency of electricity generation at the incinerator approached 100%, which no one is suggesting is remotely possible, could the combustion of plastics in incinerators recovering electricity only be seen to do anything other than contribute to increases in CO₂ emissions into the atmosphere. Indeed, at typical efficiencies of electricity generation in incinerators, the net contribution of CO₂ to the atmosphere from the plastics is around 159kg CO₂ equivalent, even though this material constitutes only 8.8% of the waste stream in our modelling. If the same plastics were recycled, then using figures from ERM's report for Defra (which are from the Ecoinvent database), the savings in CO₂ emissions would be of the order 205kg CO₂ equivalent. Assuming a 40% capture of these materials – which begins to look possible as separation technologies improve – this would imply savings of the order 82kg CO₂ equivalent.”

N.J. Themelis, New York City, May 12, 2006