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Letter to the Editor

Comments on recently reported performances of solid wastes as fuels in France

A recent paper in this journal [1] considers fuel use of waste, largely household waste, in the production of electricity and heat in France. Amongst the information given is that, on the basis that the waste is 50% carbon-neutral (an approximation frequently made), carbon dioxide emission reductions of 2.65 million tonnes accrued from use of the waste as fuel. This note seeks to draw further meaning out of this figure in terms of the viability of such wastes as fuels.

A fundamental quantity in fuel production is the energy return-on-energy invested (EROEI): how much energy in the form of heat from a particular fuel is obtained per unit energy required to produce the fuel. Clearly use of a fuel will only be viable if the EROEI value exceeds unity. The only circumstances under which use of a fuel with an EROEI value of less than unity might be possible are:

(a) Fuel use of a substance which would otherwise require professional disposal if losses resulting from the EROEI of less than unity are lower than the cost of such disposal.
(b) Fuel use of a carbon-neutral fuel with EROEI < 1 if losses incurred in its use are lower than resulting carbon dioxide reductions expressed as 'CO_2 credits'.

Points (a) and (b) above are both relevant to fuel use of household waste. Organisations which burn fuels to produce energy are assigned allowances on emissions of carbon dioxide in units of 1 tonnes of the gas. A combustion installation can emit in excess of its quota by purchasing units from another which does not require its full quota; the total amount of carbon dioxide released is unaffected by such transfer. An advantage of such 'emissions trading' is that purchase of units by an enterprise which has a carbon dioxide release rate in excess of its quota might well be cheaper, at least in the shorter term, than alternative measures such as using a different fuel or carbon dioxide sequestration.

Prices of carbon credits vary from place to place and from time to time and of course negotiation and brokerage are possible. Having regard to the fact that the waste fuel utilisation under discussion [1] took place in France we use a typical value for early 2007 of €12 (US$ 16) per tonnes of carbon dioxide. The figure given as the annual saving in carbon dioxide credits is therefore in monetary terms:

$$\text{US\$}\,(2.65 \times 16)\,\text{million} = \text{US\$}\,42\,\text{million}$$

which at the current price of about US$ 60 per barrel would purchase about 700,000 barrels of crude oil, about 5% of France's annual crude oil production which is currently about 15 million barrels per year (there being much more than this imported). Reference [1] gives the quantity of fuel the burning of which led to the carbon dioxide reductions as 12.6 million tonnes. It is a rule of thumb [2] that a tonnes of municipal waste and a barrel of oil release on burning the same quantity of heat, actually about 7 GJ. The saving in crude oil from use of the fuel is therefore 12.6 million barrels, equivalent to about 85% of France's annual oil production. The twofold savings brought about by use of the waste – carbon credits and heat from the fuel – therefore sum to about 90% of France's oil production.

This calculation is tentative and has no 'bottom line'. There are of course important factors to be considered. Whereas crude oil can be straightforwardly refined to make a range of fuels for immediate use municipal waste, besides being unhygienic and unpleasant to work with, would first require beneficiation. At the very least, removal of non-combustibles such as bottles and cans is required. The fuel so prepared would be suitable only for certain types of combustion plant and would probably leave a significant amount of corrosive ash. That is why the energy equivalence of a barrel of oil and a tonnes of waste could not possibly be re-expressed in financial terms. Even so, the calculations presented herein and possible extensions of them invoking points (a) and (b) made above indicate that solid wastes as fuels have the potential significantly to contribute to energy supply and demand in France, a developed country of population 60 million.

References

[1] E. Autret, F. Berthier, A. Luszezanec, F. Nicolas, Incineration of municipal and assimilated wastes in France: assessment of latest energy and material recovery performances, J. Hazard. Mater. B139 (2007) 569–574.
[2] J.C. Jones, Selected examples of fuel use of waste and greenhouse implications, Air Water Environ. Int. (December) (2006) 14–18.

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