Sustainable Energy Briefing 3:
Waste to energy projects

A growing number of projects are being proposed for South Africa under the label of 'Waste to Energy' where waste (such as anatomical hospital wastes, bio-hazardous wastes, electronic scrap, municipal/ domestic and industrial waste, worn out tyres, solvents, plastics and sludge) is burned instead of coal. This briefing looks more closely at why this is the case, the consequences of burning waste for energy and the alternatives to this trend.

Why burn waste for energy?

About 70% of South Africa's energy needs are met from coal (including over 92% of electricity generation and about 30% of transport fuels). Although cheap by international standards, buying coal involves significant costs for energy-intensive processes. For example a single cement kiln can burn up to 180 000 tons of coal a year.[1] Coal becomes more expensive the further you are from the coal mine.

According to a recent Environmental Impact Assessment Report into the feasibility of using waste (or 'alternative fuels') in a cement kiln, between 35 to 50% of coal can be replaced a year, depending on the composition of the waste. This means a cement company will avoid the costs of 40 000 to 90 000 tons of coal just for one of its cement kilns.

When you consider that this waste is either free, or that companies are paid to take it – then a central reason for burning waste for energy becomes clear – to make money. Indeed, there's a real risk that companies will be paid to import waste into SA from countries that have more stringent standards on burning waste for energy than SA does. We have already seen companies importing materials regarded as waste in their country of origin (and thus attracting waste disposal fees) under the guise of recycling – since very small percentages of usable materials may be economically recoverable under local economic conditions and environmental regulation.

After the World Summit on Sustainable Development there was a global commitment to 'triple bottom line accounting' i.e. to development that included social and environmental factors in addition to economic considerations. As a consequence, waste to energy projects are being re-packaged to highlight selected social and environmental benefits. So, for example, waste to energy projects are promoted by industry because they:

- "reduce the environmental impacts of using coal…as well as reduce the amount of waste material that would traditionally be disposed of to landfill or incinerated."[2]

- Are "in line with initiatives of National Government, particularly the National Waste Management Strategy (NWMS) which focuses on waste prevention, waste minimisation and the re-use of waste materials."[3]

However, as shown below, burning waste for energy has many negative consequences and would legitimise the generation of waste when we should be re-designing production to avoid waste.

What are the consequences of burning waste for energy?

From the outset, its important to note that the consequences of burning waste for energy depend on what waste is being burned. Certain wastes, e.g. biomass such as agricultural waste, can be safely burned for energy, although bio-digestion to produce gas as a fuel and compost is generally preferable.

When waste has chlorine or metal in it (as in plastics, tyres and solvents), burning it doesn't destroy the toxins. Instead it displaces some to 'landfills in the sky' and concentrates the rest to create toxic ash. In addition, when waste is burned new pollutants are formed, including organochlorines (such as dioxins and furans) – which are the most toxic pollutants known, causing cancer, birth defects and impaired child development. Air pollution does not become acceptable just because the heat energy of incineration is utilised.

In addition to air pollution directly impacting on respiratory health, many of the toxins are bio-accumulative, which means that they build up in the body over time. They enter the body via the food chain – by eating crops that are grown downwind of waste incineration facilities, meat from animals fed on such crops or fish, feeding on fish, that have built up high body concentrations. They are passed on through breast milk, so children breastfed by mothers who have high levels of organochlorines in their bodies will receive concentrated doses of these toxins, which disrupt hormone activity and childhood development.

With standard waste incineration the ash is dumped in landfills, from which the toxins will eventually leach or leak into groundwater – the quality of the landfill lining will determine how long this will take (assuming no flooding or subsidence). In cement kilns the ash becomes part of the product, but there are no proposals to label such cement as containing toxins, even those these may be released (off-gas) over time. Some pollutants will be captured in pollution-control technology, such as filters, that will be land filled.

Burning waste for energy also entrenches bad waste management practises. As described below, there are a number of alternative ways to dealing with waste that are environmentally, socially and economically beneficial. However, these require changes in existing waste management, rather than the strengthening and support of such practices.

What are the alternatives?

There are a number of alternatives to burning waste for energy. When considering these alternatives we need to question 'How is waste created?' The answer is that we make waste by mixing a wide variety of materials like garden refuse, glass, tins, plastic and paper together. By throwing all these materials together, we lose access to their inherent energy (energy used in production) that could be exploited through re-use or recycling.

When deciding whether to burn, re-use or recycle material we need to consider the energy balance. Energy balance refers to how much energy was used to make the material, and how much is available for use at the end of the product's life – either by re-using (bottles, bags), recycling (metals) or from burning it for the calorific value. For example, it makes better energy sense to recycle paper than to burn it and make virgin paper, due to all the energy involved in wood cultivation, transport and pulping.

- With this in mind, one alternative to burning waste for energy is to separate waste at source i.e. separate garden refuse, glass, tin, plastic and paper, and encourage recycling and reuse. While it would be expensive to start up waste separation, the long-term benefits in terms environmental, social and economic costs (because money would be saved) would fully compensate for this initial outlay. Government procurement policies requiring recycled content would stimulate demand for recycled product that is currently disadvantaged by scale.

- All organic wastes could be bio-digested, producing both methane-rich gas and compost. While released methane significantly contributes to global warming, it can be captured and used for power

and/or heat generation, which greatly reduces the contribution to climate change (methane has 23 times the global warming impact of carbon dioxide, which is released when the methane is burned).

- Another intervention is cleaner production. There has been great progress internationally as production processes and products are re-designed to avoid waste, or to change waste streams so that they are suitable as input to other processes. However, this is only economically attractive where cheap dumping or incineration options are penalised. South Africa has committed to cleaner production and sustainable consumption in policy, but this will mean nothing without full-cost accounting and ruling out cheap-and-dirty waste management options.

Landfill gas to generate power

One form of 'Waste to Energy' project currently being considered by many municipalities is to capture the gas released by rotting organic matter in landfills and use it to generate electricity. The Department of Minerals and Energy recently released a draft document on the potential of landfill gas (which is mainly methane) for power generation. According to the document, of the 453 landfill sites in SA, 53 could potentially be used to generate power.[4] Not only could this be environmentally friendly, with the right technology, but money can also be made by selling electricity and "carbon credits" – greenhouse gas emission reduction units generated because, instead of being released into the atmosphere and contributing to global warming, methane is captured and used.

The challenge with such projects is to ensure that they do not perpetuate current unsustainable waste management practices and/or unacceptable impacts on local communities. Also, only about a third of methane from the decomposing biomass material in municipal landfills is captured. If all the bio-digestible (organic) matter were separated at source, all the resulting gas could be used, with compost as a by-product. The prospects of short-term financial return for municipal management, even if it is through foreign investment, should not prevent implementation of sustainable waste management and optimal resource use. There may also be better uses for the gas than burning in an inefficient open-cycle gas turbine.

[1] Environmental Impact Assessment Report for the proposed implementation of an alternative fuels and resources programme for kiln 3 at the Holcim South Africa Dudfield Plant, North West Province, complied by Bohlweki Environmental, 2 September 2004
[2] Ibid page ii.
[3] Ibid page ii.
[4] Landfill Gas Resources for Power Generation in South Africa, Department of Minerals and Energy, October 2004.