ENERGY

ENERGY POLICY STATEMENT: 09/06

ENERGY FROM WASTE

Institution of MECHANICAL ENGINEERS

For too long the UK has thrown a large proportion of its annual 300 million tonnes of waste to landfill. Indeed, we throw so much away that we could fill the entire Albert Hall with landfill-bound waste every two hours. We can no longer continue in this vain; not only is landfilling environmentally unacceptable, but local authorities also face challenging targets to reduce the amount of biodegradable waste going to landfill. Is there an answer?

Energy from Waste (EfW) plants convert waste, which has significant energy potential, into usable energy in the form of electricity, heat and/or transport fuels. Importantly, EfW plants are not incinerators; they are purpose built to provide usable energy and not to simply reduce the volume of our waste. EfW has huge potential – the technology could produce 15% or more of UK electricity by 2020, whilst drastically reducing the amount of waste going to landfill.

IMechE urges Government to make the most of energy from waste by:

- **Reviewing its energy strategy** to make full use of the resources we have available. Redefining waste as an energy resource rather than a problem that has to be dealt with will allow the UK to release EfW's potential to produce clean and cheap energy;
- **Not wasting the heat**. Any new EfW plant should be developed in CHP mode. Combustion technology inherently produces both heat and power, in the ratio of about two to three times to one. Excess heat produced in the combustion process can be used to heat our homes and businesses;
- **Recycling what's worth recycling**. Recycling is a worthy exercise, but only if there is a market for the recyclate and the process of recycling does not require significant energy input.

ENERGY FROM WASTE

WHY IS ENERGY FROM WASTE AN ISSUE?

In the UK, we have traditionally dealt with waste in one of two ways: landfill or incineration. However, neither method is up to standard – both emit large amount of greenhouse gases and, ultimately, don't dispose of all our waste. The UK is now reluctantly sending less waste to landfill. The European Landfill Directive requires the organic fraction of landfilled waste to be reduced by 65% by 2020[1]. Put simply, the UK needs to radically change the way we deal with our waste.

The current waste mantra is to recycle. According to Defra, 34% of household waste is recycled. Indeed, IMechE fully supports recycling when it is the appropriate use of the particular waste stream. For example, recycling is an effective and efficient means of treating used glass and metals. However, if there is no market for the recycled good or the process of recycling requires significant energy input (and therefore produces greenhouse gasses), why do we continue to do it? Such a rigid dogmatic approach is counterproductive.

On the other hand, our energy supply is a becoming an ever more important issue. Much of the UK's centralised electricity generation capacity is not only carbon intensive but is also due to be decommissioned in the next decade or two. Further, whilst the renewable alternatives are low or zero carbon, some are subject to intermittency. Diversifying and securing our energy supply must be a priority. Energy from Waste should play a more significant role in the UK's energy policy.

SO WHY ISN'T THE GOVERNMENT DOING MORE?

Energy from Waste is often not fully understood. EfW plants are often deemed incinerators, which is inaccurate. Incinerators are simply designed to reduce the volume of waste and do not consider waste as means to produce energy. Indeed, the last municipal waste incinerator in the UK closed down more than a decade ago. Despite this, even the Government doesn't seem to understand this distinction. Defra distinguishes between 'EfW with incineration' and 'EfW without incineration'[2]. To reiterate, EfW is not incineration!

EfW is also considered very polluting. Again, there is little substance to such a claim. Firstly, EfW plants have to adhere to the very stringent Waste Incineration Directive (WID)[3]. The net result is that emissions from a combustion EfW plant are required to be ten times lower than from an equivalent coal-fired power station[4]. Secondly, old incinerators had a bad reputation; they released harmful dioxins and furans in to the atmosphere. However, modern EfW plants are entirely different. WID limits dioxin emissions from EfW plants to one billionth of a gram per cubic metre – equivalent to just one third of a sugar lump in Loch Ness! Indeed, Defra seem to acknowledge this fact, concluding: "Dioxin emissions from modern energy from waste plants are very small compared with other common environmental sources such as building and forest fires, and even fireworks"[5]. Put simply, EfW's reputation is unfounded.

LEARNING FROM OTHERS

Most major EU nations with green credentials utilise EfW far more than the UK. The most notable example is Denmark, where landfilling is deemed unacceptable. The Danish have a network of local EfW plants built close to population centres (so waste doesn't have to travel far). Both the electricity and heat produced is used in the local community. Indeed, so important is the use of heat in local communities that Denmark has over 400 individual district heating schemes. By no means is Denmark unique. Amsterdam is home to the largest EfW plant in the world, which produces enough electricity to power up to 75% of the city's homes. In Vienna, the Spittelau EfW plant generates 36,000 MWh of electricity and heats 190,000 homes, whilst removing 263,200m^3 of waste.

WHAT SHOULD WE DO ABOUT IT?

Clearly, we believe the Government should be doing far more to promote energy from waste. So what would we do differently?

1. **Review our energy strategy** to make use of the resources we have. Recognising EfW as part of the UK's energy strategy rather than as means to treat waste. Unless EfW plants are seen as clean, safe, well-proven energy recovery solutions it is extremely unlikely that the UK will meet its 2020 energy and landfill targets;
2. **View waste as a resource not a problem**. In modern society waste is inevitable, regardless of how environmentally aware a given society is. Different types of waste (waste stream) will have different properties lending each to a particular use. For example, waste metals can be easily and efficiently recycled yet glass requires significant amounts of energy to do so;
3. **Stop wasting heat**. Combustion based power plants inherently produce both heat and electricity, in the ratio of about three to one. Traditionally, this heat is released into the atmosphere. By employing simple technology, we can capture this heat and use it for space and water heating in a district or community scheme;
4. **Recycle recycling myths**. The UK will never solve its waste problem through recycling alone; recycling often requires large amounts of additional energy and many waste streams do not lend themselves to it. Let's get smarter about what we do with our waste.

READILY AVAILABLE EFW TECHNOLOGIES

There are four main types of available EfW technology readily available. The type of technology employed should, in large part, depend on the fuel it will use (i.e. the waste the plant will treat).

Thermal combustion is the most common and well-proven thermal process that can be used with a wide variety of fuels where moisture content is low. Fuel is used to heat water, which drives a steam turbine to generate electricity. A useful by-product of this process is heat energy, which, if captured, could radically improve the operational efficiency of the power plant. Combustion plants are the most common EfW plants used in the UK at present, although many do not make use of the heat.

Gasification is a thermal process where insufficient oxygen exists for all hydrocarbons to react. The process produces a gas (usually methane), which can then be used to fuel a gas turbine generator. The main disadvantage is that the process requires significant capital investment.

Pyrolysis involves the thermal break-down of organic material to produce combustible gases, often pyrolysis oil. This oil may be used as liquid fuel for power generation or in a boiler. Neither pyrolosis nor gasification have achieved significant market penetration as of yet.

Anerobic digestion is a biological process that is best used with liquid or semi-liquid wastes, such as animal slurry. The process deals with wet wastes well but is only successful on a small-scale, such as a farm, and is relatively inefficient. However, this is often favoured by many as it is seen as the 'greener' option, although there is little substance to this claim.

"EFW HAS HUGE POTENTIAL – THE TECHNOLOGY COULD PRODUCE 15% OR MORE OF UK ELECTRICITY BY 2020.

REFERENCES

1 European Council Directive: 1999/31/EC

2 www.defra.gov.uk/environment/statistics.wastats/bulletin08.htm

3 Directive 2000/76/EC

4 IMechE (2008). Energy from Waste: A Wasted Opportunity?

5 Defra (2006). Review of England's Waste Strategy

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