To CHP or not to CHP, that is the question

Combined Heat and Power (CHP) can significantly improve the carbon footprint of energy from waste plants but has the government done enough, fast enough to make the economics work? *Paul Carey,* managing director of MVV Environment investigates.

WITHOUT SOME kind of real economic support from central or local government, district heating is unlikely to see much further development in the UK. This is because the nature of domestic and commercial heat demand is not constant, plus there is the high capital cost of building the district-heating network.

To its credit BERR, now to work alongside DECC (*see page four*), has undertaken a significant amount of work on a Renewable Heat Obligation designed to provide support.

This works just as the Renewables Obligation does for renewable electrical power and the granting of Renewable Obligation Certificates (ROCs) does for CHP schemes, which provide limited support.

However, with the current wave of PFI projects, it is of great concern that no form of Renewable Heat Obligation will be in place in time for such schemes to build in district heating as part of the base economics.

EfW and waste management

Energy recovery from household waste has, for a long time, been seen as a pariah technology for waste management. In recent times attitudes have softened and increasingly local authorities are becoming more receptive to the idea of thermal treatment as a legitimate response to the call for reductions in landfill.

As waste management facilities, EfW plants are very efficient at diverting biodegradable municipal waste (BMW), one of many targets in the EU's Landfill Directive, away from landfill. But when looked at from the other end of the telescope, the story is not so good.

A key part of the argument in favour of EfW is that it produces electricity that would otherwise be generated by fossil fuels, e.g. coal. The reality is that when compared to modern coal or gas power stations, EfW plants are often not very efficient at recovering energy locked in the waste materials.

MVV's CHP plant in Offenbach, Germany which processes 250,000 tonnes of waste

Improving efficiency

Significant improvements in overall thermal efficiency can come from using some of the energy liberated directly in the industrial process for heating purposes. The energy in the waste is generally used to raise a high temperature and pressure steam in a boiler. Normally, this steam is fed into a turbine generator that produces electrical energy in a very convenient and flexible form, which can be transmitted to the end user who can be a considerable distance away.

Unfortunately in the UK only about 23% of the energy is converted to useful electricity, often less. By bleeding some of the steam off, either before it gets to the turbine or as it passes down the turbine producing rotational energy, the thermal efficiency of the EfW plant can be significantly increased.

The steam can then be used to displace steam raised by gas or oil firing (coal fired boilers are rarely used these days except in power stations). In terms of carbon dioxide emissions, the savings (in terms of emissions eliminated from the conventional fossil fuelled steam) can be significant. It sounds too good to be true, and begs the question: Why is CHP not used in more EfW plants?

In reality, for CHP to work the value of the steam supplied to the end user has to be at least the same value as the lost electrical power. In the energy world you don't get something for nothing, and by supplying steam you have less energy going into the turbine, hence less electrical power coming out of the generator.

Contrary to popular belief, there is little usable waste heat in a normal UK EfW plant; the large amount of heat that is not turned into electricity is low-grade heat and useless for any sensible purpose.

On top of the loss in power generation you also have the capital and operating costs of the steam pipe to consider, and depending on the location of the steam host, this can be considerable. In Mannheim, MVV Umwelt operates a CHP steam network some 15 km in length transporting 80 tonnes per hour of steam, at up to 18 bar pressure, to some 15 customers up to 2 km away. The total operating and maintenance costs amount to some €300,000 annually.

Getting to grips with the rules

Moreover, to achieve the best economics, the steam demand should be as constant as possible on a 24/7 basis. For industrial customers this is often the case and lends itself to maximising the potential use of heat.

To further assist the economics, the government has, since 2005 allowed ROCs to be earned on power produced from EfW plants operating in CHP mode, provided they meet the threshold of good quality CHP. Incidentally, while the rules are understandable, they are not the easiest to get to grips with.

Moreover, ROCs are only given on the proportion of power that is attributable to the organic fraction of the waste, and so far the system that OFGEM employs to measure the organic content has not been fully developed.

Nor is it necessarily going to be practicable given the heterogeneous nature of household waste. To add to the potential confusion, the rules to ensure a scheme achieves good quality CHP were adjusted last year with the effect (perhaps unintended) of making it harder for EfW schemes to get ROCs. Depending on the price paid for the steam, CHP in this form can be less viable than plain power generation.

Speedy support

And what of other forms of heat load? Often asked for by clients and bidders in PFI tenders is the desire for, and the willingness to provide, district heating. The pipe network of district heating is basically just like a domestic central heating systems, only bigger, and laid in heavily insulated pipes under the ground. Mainly used in cities it represents another way of using heat.

Used in continental Europe (there are very few examples in the UK, e.g. Sheffield and Nottingham) the networks were almost totally built and funded by city authorities rather than commercial undertakings.

Due to high operating costs and variable heat demand even newly built systems need to be subsidised directly or indirectly.

Substantial support, speedily provided, will be necessary from government to build up the required infrastructure of CHP plants. Perhaps the new broom at the new Department of Energy and Climate Change might speed up things. Time is of the essence, Mr Milliband. RWW

Case study: CHP in Germany

THE WASTE-FUELLED power station of Energieversorgung Offenbach AG uses 250,000 tonnes p.a. of communal waste to generate about 50.000 MWh of electricity and 140.000 MWh of usable heat.

This heat is fed into a communal heating system that serves around 26,000 inhabitants of Offenbach and surroundings. This heating system alone saves prevents the emission of nearly 30,000 tonness of CO_2 every year.