A Nottingham Perspective

With Nottingham's incinerator having received planning permission to extend its operating capacity from 150Kt to 250Kt MSW per annum, sustainable energy development manager, Jerome Baddley, discusses the varying responses to the development

Nottingham is home to the UK's oldest and largest District heating Network and a considerable private wire power network. Established in 1975, the network derives 90 percent of the energy from waste incineration. The final 10 percent of the energy comes from 14.4MWe of gas combined heat and power.

The combustion of residual waste is used to provide low cost heat to 4500 of the city's poorest households and cut the carbon emissions of the city by around 20000 tonnes annually.

A proliferation of energy from waste (EfW) in the UK is now proposed as a leading solution to the dual challenges of tough renewable heat targets and a crisis in available landfill capacity. The revised Waste Framework Directive also looks set to promote more efficient EfW plants as "energy recovery" rather than "waste disposal". Before we undertake this journey, however, it is worth looking closely at the Nottingham example to see if there are lessons to be learnt.

It is a little known fact that Nottingham is actually the birthplace of EfW. In 1886 Albert Fryer invented the first "destructor" as incinerators were known. Fryer formed a partnership with the Manlove and Alliot company of Nottingham to build and distribute the technology globally from its factory in the city.

Nottingham's current incinerator was built at the same time as the heat network that supplies most of Nottingham city centre. The plant is operated by WRG, a private contractor, and burns 150Kt of mixed wastes each year. This generates 190 GWh of steam and hot water. The steam is then sold to Enviroenergy, a 100 percent local authority-owned energy company, which in turn owns and operates the heat and power network. The steam is used to turn the 14.4 MWe of combined heat and power plant and supplies 130 GWh of heat and 30 GWh of power to the city every year.

Nottingham's incinerator burns 150Kt of mixed waste each year

Taken as a percentage of Nottingham's total annual heat and power consumption, this plant and network alone supply 3.5 percent and 2.1 percent respectively of the city's demand. This alone puts Nottingham at the top of the league in the UK for locally generated energy from renewables and waste, the UK's most energy self-sufficient city.

Extended Capacity

NOTTINGHAM'S INCINERATOR has just received planning permission to extend its operating capacity from 150Kt to 250Kt MSW per annum with the installation of a third line. While the planning process was understandably contentious, the expansion will release significantly more energy for use locally in the local heat and power network. The extension to the heat network to use the additional capacity has already begun.

The main reason for suspicion and anger at the proposed incinerator expansion in Nottingham was the issue of deep-seated concern around air quality and health. While

many other valid arguments were also put forward around the waste hierarchy, social impacts, noise, visual intrusion and so on, air quality was the prime mover behind the majority of those engaged in the anti-expansion movement.

This is not without basis, in a historical sense at least. While Nottingham could be called the birthplace of incineration, there is a huge public health legacy that goes with that. Although the EU Waste Incineration Directive and increasingly stringent requirements since have dramatically curtailed the hazardous emissions from incineration, people and communities have long memories. Many of the residual health and environmental impacts still linger in populations and the soil downwind from older plant, including in the communities and allotment gardens of Dales Ward in Nottingham.

On one level the additional local energy generation is welcome and will contribute to increasing Nottingham's energy self-reliance. While there are many other sticks to beat incineration with, the heat arising from EfW, if distributed efficiently, is currently lower carbon than natural gas. The expansion of the district heating (DH) network has also been pushed by the increasing heat resource available from incineration. The DH expansion has also been pulled by the need for low carbon heat sources, particularly the favourable view of the city planning department in compelling developers to connect to district heating, through the local low carbon renewable energy requirements for new buildings.

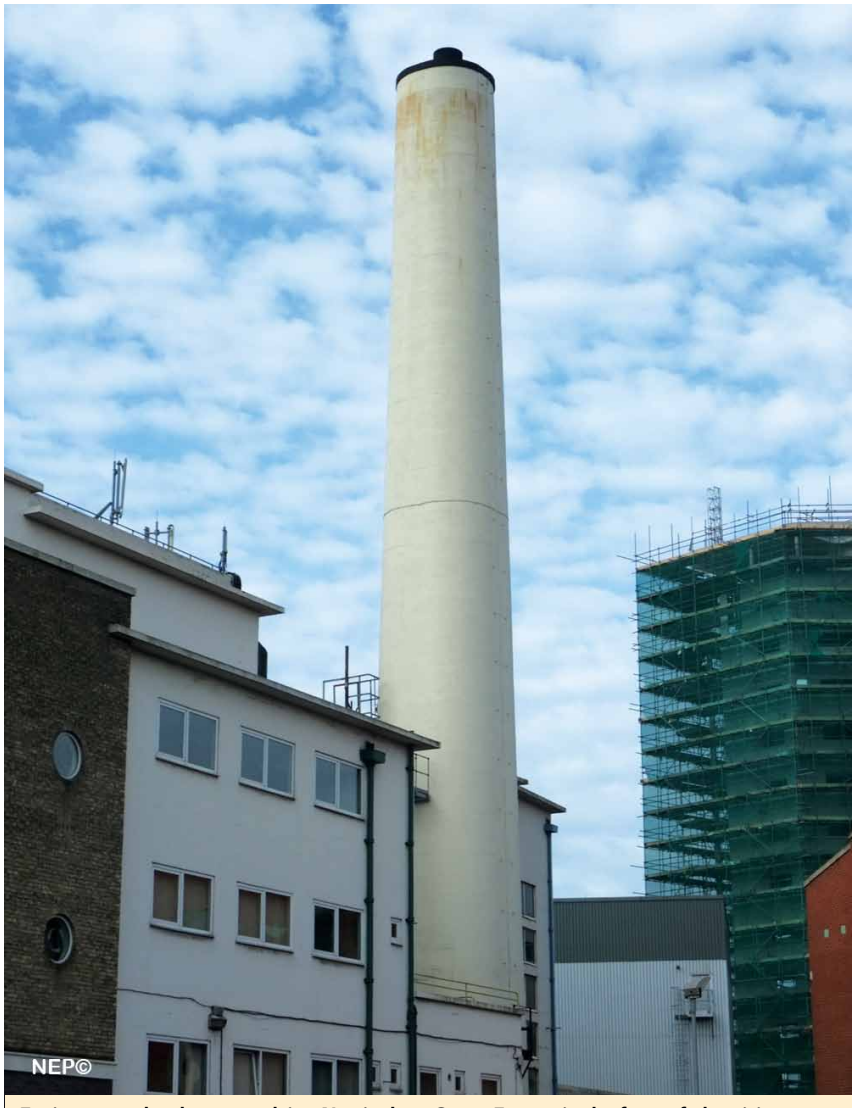
Both the Nottingham Energy Partnership and the DH network operator, Enviroenergy, have independently undertaken waste modelling and sampling to establish biomass and plastic proportions in the incinerator waste stream. This is critical in establishing whether EfW with district heating is actually a better option than natural gas in terms of carbon emissions, but also in enabling the DH network operator to claim renewable energy payments (ROCs) for electricity generated from the biomass proportion of the waste.

The Carbon Factor

PLASTICS MAKE up only 10-15 percent of the waste stream by weight, but their high calorific value means they provide 30-40 percent of the energy supplied to the DH network. As plastics are fossil derived, they contribute almost 100 percent of the Greenhouse Gas emissions for the resulting heat and power. So depending on whether your focus is on cutting waste weights, maximising energy generation or cutting CO_2 emissions, plastic presents a number of problems.

In Nottingham, for now, the plastics balance seems low enough to support a net carbon saving versus gas from the heat circulating in the pipes. It is important to note, however, that it will not take a massive shift in waste composition, through increased recycling and composting rates to push the plastics content of the waste high enough to remove that benefit. It is also important to consider that Nottingham City Council, while having 100 percent rights to the steam from the incinerator, also has an obligation to provide the 150Kt of waste per annum to the heat plant.

This delicate calculation is not helped either by the fact that EfW is given a preferential carbon factor in building regulations and the Standard Assessment Procedure. The carbon factor for EfW was generated through modelling with the biomass environmental assessment tool, with the assumption that all incinerators are being fuelled by biomass rich refuse derived fuel (RDF) 10 percent plastic, rather than black bag municipal



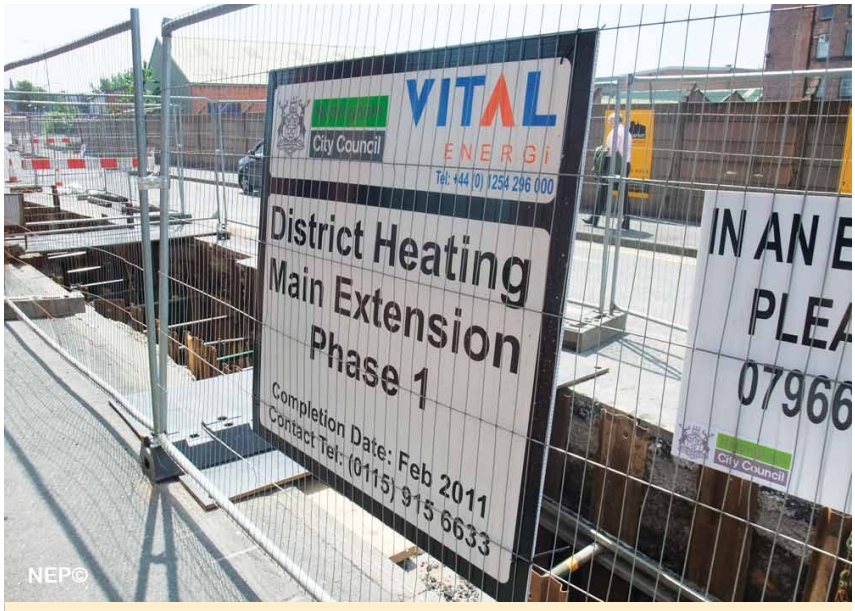
Enviroenergy has been supplying Nottingham Green Energy in the form of electricity or hot water to properties across the city centre for over 30 years

solid waste (MSW), as it the case in Nottingham. Clearly biomass-rich RDF has significantly different calorific and compositional values to MSW, the plastics content is at an absolute minimum 10 percent and rising.

While this may help to encourage more EfW and district heating in the short term, when the real emissions become clear plastic content has risen and proper calculations are demanded to back up local carbon budgets, local authorities relying on EfW and DH to cut their emissions could be in for a bit of a shock.

While we have carried out an analysis at NEP for the Nottingham heat and power network, currently there is no regulated way to assess and attribute the carbon emissions factor for district heat and power derived from multiple fuel inputs, so Nottingham city just calls the heat in the network "zero carbon", a stance backed up by the approach taken by the Carbon Reduction Commitment. The implication is that the carbon is then instead loaded onto the power generated by the CHP and exported to the grid and private wire power network.

None of this would be a problem of course if incineration were covered by the EU ETS and the carbon emissions accounted and paid for by the incinerator operator. The natural gas burnt by the heat network operator, to provide back up for the incinerator, *is* covered by the EU ETS, so could legitimately be omitted from any factor applied to the heat or power supplied as potential double counting.



Nottingham's incinerator received planning permission to extend its operating capacity

Burning Plastic

WITHIN NOTTINGHAM'S city limits the waste contractor who provides the city's recycling service is already able and happy to collect and process plastic film as well as the usual recyclable plastics. Why then does the city not promote clean plastic film as suitable for recycling? The given reason is the increased risk of food contamination increasing waste reject rates, however, the low weight of plastics and weight-based targets for recycling don't really encourage a focus on removing these elements from the waste stream. This, for me, is the nub of the recycling/incineration paradox.

EfW is only as sustainable and environmentally benign as the fuel that goes into it. Burning plastic is easy and high-energy yield, however very high oil prices are again on the horizon, making plastic recycling more attractive. Increasing recycling and composting rates are diverting biomass from incineration and there is a need to keep carbon emissions from fossil-derived waste combustion down.

Even with more waste being diverted from landfill, is there a danger that once Nottingham and others eventually succeed in diverting plastic film to recycling, that a modern wave of EfW could become redundant due to lack of highly calorific fuel?

There is an argument here for a renewables obligation for EfW with DH networks, to ensure a minimum biomass fraction, diverting some of the biomass currently destined for co-firing with coal. Valuable biomass would be better burnt close to heat and power users to supply low carbon CHP than just low carbon electricity in power stations.

There is also a need to actually provide more incentives for local authorities to recycle plastic films and the mixed plastics that currently don't get picked up by most kerbside recycling and aren't incentivised by weight-based targets. The infrastructure for recycling this refined natural resource must be available when, in the near future, the rising oil price makes it viable.

Incineration becoming "energy recovery" raises many more questions than answers! CIWM

Enviroenergy tower's green energy is distributed through a network of pipes beneath the city's roads