Renewable Energy Select Committee
Topic Sheet - Waste as a source of energy

Introduction

(*A glossary of common terms used in relation to this topic is given at Appendix 1.)*

> *'A shift in perception is required. Waste needs to be recognised as a resource.'*[1]

The Institution of Mechanical Engineers believe waste could provide 20% of UK electricity requirements, making a significant contribution to the future UK energy mix while also helping to achieve targets for renewable heat and transport.

The Energy from Waste (EfW) industry is also capable of rapid development and installed capacity (thermal treatment) could double by 2016.[2] The Waste Strategy for England expects that by 2020 a quarter of municipal waste will be used to generate energy.[3]

KCC's 'Low Carbon Opportunities' identifies gas from landfills, sewage treatment and biodegradable wastes as *renewable* biomass resources which are available across Kent.[4]

The four main techniques used to extract energy from waste are combustion, pyrolysis and gasification which are thermal processes and anaerobic digestion (AD) which is a biological process.

Although energy generation from combustion and biological treatment of waste can both result in 'energy from waste', the term EfW usually refers to treatment by combustion and AD is referred to separately. The incentives offered for these treatments are different and WRG, in their evidence, stress the need to distinguish combustion, for the purpose of generating energy, from incineration, for the purpose of reducing waste volume.

Policy Drivers

The focus of legislation on Energy from Waste (EfW) has tended to be waste treatment, rather than energy production and this has resulted in EfW plants not being treated in the same way as other power stations.[5] It is incentivised mainly through the Landfill Directive which aims to reduce landfill and its environmental impacts (water, air and soil quality, climate change). Waste sent to landfill is subject to landfill tax, currently around £40 per tonne, and this increases by £8 per annum until 2013.

The amount of biodegradable municipal waste sent to landfill must be reduced by 2010 to 75%, by 2013 to 50% and by 2020 to 35% of 1995 levels. The penalties imposed upon Local Authorities under the Landfill Allowances Trading Scheme (LATS) scheme have been largely unworkable but EU Landfill Directive targets for

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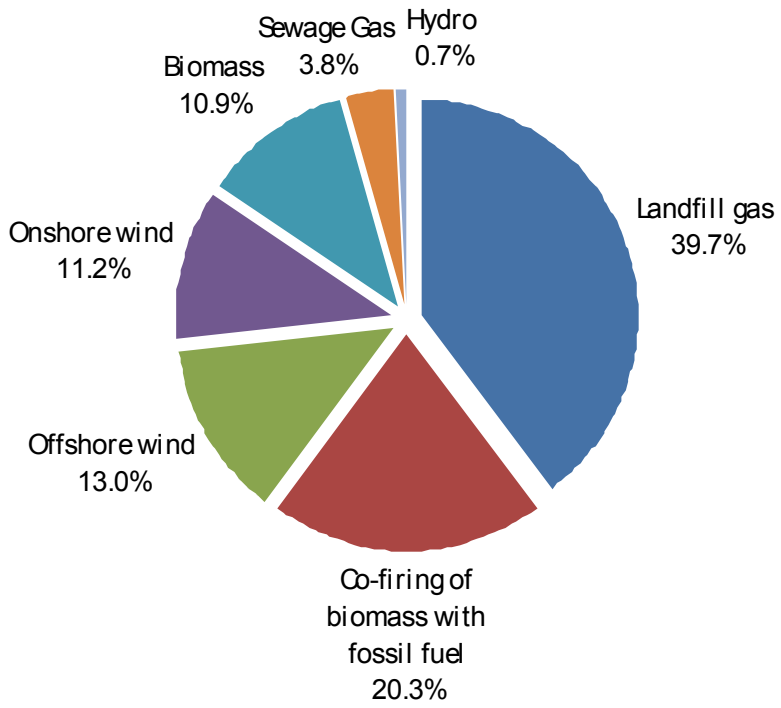
[1] Written evidence – Karl Jansa, Locate in Kent
[2] Written evidence – WRG citing the European EfW Federation
[3] Written evidence – Environment Agency
[4] Along with coppiced wood, sawdust, arboricultural trimmings and energy crops
[5] Institute of Mechanical Engineers Report: Energy from Waste a wasted opportunity?

the UK are likely to be met due to an increase in recycling and a decrease in waste arisings influenced in part by the economic downturn.

EfW (combustion) is currently the cheapest alternative to landfill for non-separated waste. Further government incentives are expected which will serve to make EfW and other alternatives to landfill increasingly attractive.[6]

Energy policy in relation to the generation of renewable electricity has been through the Renewables Obligation (RO) which is in effect until 2037. Although waste that is either biodegradable or combustible can be used to generate energy, only energy from the biodegradable fraction of waste is considered to be 'renewable' and only this fraction (around 65% of municipal solid waste) is eligible for Renewable Obligation Certificates (ROCs), which have up to now been the main mechanism to incentivise renewable energy. A breakdown of ROCs issued in England, shown below in Chart 1 shows that landfill gas and sewage gas together account for 43.5% of ROCs issued.

Chart 1: Breakdown of ROCs issued in England by technology type
Data source: Ofgem Renewables Obligation: Annual Report 2008-9, February 2010



The ROC system has not incentivised EfW. However, a Renewable Heat Incentive (RHI) is to be introduced by the government in April 2011 and is currently being consulted upon.[7] WRG have indicated they will be lobbying for recognition of the contribution that EfW CHP can make to renewable energy targets, so that heat recovery by this means is properly incentivised.

[6] Written evidence - WRG
[7] A Postnote from the Parliamentary Office of Science and Technology on Renewable Heating is attached.

KCC and Kent districts' responsibilities

KCC is the household waste authority for Kent; the 12 Kent boroughs and districts are the collection authorities and they send their waste (with the exception of green waste in some cases) to KCC for disposal. Together, the 13 councils make up the Kent Waste Partnership (KWP) whose Officer Advisory Group meet every 3 months to take forward the Joint Household Waste Strategy which was adopted in June 2007.

A report commissioned by the KWP on waste management infrastructure in Kent had a number of key findings directly or indirectly relating to energy from waste, in particular:

- In-Vessel Composting (IVC) facilities will be required in North East Kent (Blaise Farm now provides this service) and in North West Kent.
- There is no need for new EfW capacity to treat household waste but disposal capacity should be optimised at Allington
- There is a wide disparity between districts in the amount of household waste recycled and the amount composted.

The waste arisings from Kent households (municipal waste) are about one sixth of the arisings from the business sector.

KCC operates 5 transfer stations *which accept some trade waste (chargeable)* at:

Dunbrik Transfer Station, Sevenoaks
North Farm Transfer Station, Tunbridge Wells
Church Marshes Transfer Station, Sittingbourne
Whitfield Transfer Station, Dover
Hawkinge Transfer Station, Folkestone

KCC is responsible for preparing a new Local Development Framework for minerals and waste in Kent which will replace the Local Plans which have been in place since 1995 (and did not take into account energy from waste).

With regard to planning, where there is local opposition to the development of substantial energy from waste plants this tends to relate to the additional traffic generated[8] and so this aspect is a major consideration when making decisions about siting additional facilities that may be required.

East Kent Joint Waste Project

This project involved waste management officers from Canterbury, Dover, Shepway, Thanet and KCC who have together developed a co-ordinated approach in order to deliver cost savings and efficiencies. A Nominal Optimum Model (NOM), which standardises collection methodology, is part of this process. One of the implications of the project is the reduced energy and fuel usage to be achieved by optimising property requirements and vehicle journeys. Another is the ability of KCC to strategically manage the waste streams within East Kent.

[8] Written evidence – South East Partnership Board

EfW in Kent - WRG - Kent Enviropower

KCC's contract with Kent Enviropower involves the commitment to supply a minimum quantity of the municipal waste collected in Kent to the facility and this quantity equates to just under 40% of the total MSW (c. 800,000 tonnes per annum).

Kent Enviropower at Allington Quarry is one of two EfW facilities in the UK operated by WRG. Allington EfW processes 500,000 tonnes of waste per annum using fluidised bed technology, with an export capacity of 34MW electricity which is sold directly to the grid, offsetting 77,000 tonnes of CO_2 per annum. The plant treats municipal as well as commercial and industrial waste. The EfW plant also powers a materials recovery facility (MCF) which processes up to 65,000 tonnes per annum of recyclables.

The Allington plant currently operates at 25% thermal efficiency, as it does not utilise the heat produced by the EfW process[9]. WRG's other UK plant in Nottingham, which is around one third of the size of Allington, generates 375GW high pressure steam annually which, through 60km of district heating main, supplies a number of major sites with heat including two large shopping centres, the National Ice Arena, Capital One's UK HQ, Nottingham Trent University, The Guildhall plus approximately 5,000 residential customers.

Retrofitting combined heat and power (CHP) is possible and evidence from WRG indicates they would be supportive of such an initiative and are willing to explore the feasibility of developing district heating infrastructure, which could potentially raise the Allington plant's thermal efficiency to 75%. Retrofitting CHP would need the involvement of 'a local third party heat off-taker' and the development of an energy service company (ESCo)-type structure.[10]

Landfill gas as a resource

The methane which would naturally result from the biodegradation of organic waste, unless captured or capped off, escapes into the atmosphere and contributes, to the enhanced greenhouse effect. Although short-lived in the atmosphere (12 years as compared to 100 years for CO_2) methane is 23 times more potent as a greenhouse gas. In any event, Landfill sites in the South East are running out fast and the region may reach its capacity by 2020.

> *'There are six sites in Kent which generate electricity from landfill gas for export into the national electricity grid. The scope for utilising closed Local Authority landfills is limited. There is potential opportunity for small scale generation for on site use at Richborough, Church Marshes and North Farm Landfills'.*[11]

A pilot project to investigate the potential for such generation is about to begin at North Farm Landfill.

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[9] DEFRA administers the government's Waste Infrastructure Development (WID) Programme for England which oversees the allocation of Private Finance Initiative (PFI) credits to assist local authorities in building new waste plants. Allington was commissioned prior to the injection of this funding and it should be noted that the primary aim at the time of procurement was waste management rather than energy production, for which it was an early example in the UK.

[10] Written evidence - WRG

[11] Written evidence – Environment Agency

Anaerobic Digestion

Anaerobic Digestion (AD) involves the breakdown of biodegradable waste by microbial activity in the absence of oxygen to produce biogas or methane (CH_4). The technology is well advanced and guidelines were issued by DECC in December 2009 for the injection of purified biogas into the gas grid.[12]

The technology is supported by the Environment Agency provided there is careful balancing of the recovered value and the environmental impact. Food and agricultural wastes (manure and slurry) are most suited to AD and, when collected separately, the treatment of food waste by this process is more effective than other treatment methods, in both energy and carbon reduction terms[13].

It should be noted that AD requires homogenous waste such as that derived from the sewage industry and that if more varied sources of waste are used it is likely that a pre-treatment would be required. There is also an end product of dried sewage sludge and the bad smells associated with the process mean that careful siting of facilities is required.

> *"The NFU has a vision for 1,000 on-farm AD plants by 2020 and we firmly believe AD can add value to the agricultural sector, while demonstrating how farmers can provide part of the solution to the problem of climate change."*[14]

The National Farmers Union commented in their evidence to the select committee on the complexity of regulations affecting farmers wishing to undertake small scale energy generation from waste, even where no third party inputs are involved. A portal to assist farmers, local governments and commercial organisations understand the planning, environmental and funding issues in relation to AD can be found at: http://www.biogas-info.co.uk/.

The extent of regulations can be seen from checklists which are available to enable farmers to check compliance with waste regulations and these can be found at: http://farmwasteen.netregs.gov.uk/libraries/document/745.pdf

In addition to the option of injecting of biogas into the gas grid, methane produced from AD can be utilised onsite by:

- burning it to generate electricity
- purifying and bottling it as vehicle fuel

Alternatively, it can be piped a short distance and used as a combustible fuel.[15]

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[12] To access this guidance please click on: Biomethane into the gas network - a guide for producers
[13] DEFRA Waste Strategy Factsheet: Energy from Waste and Anaerobic Digestion
[14] NFU Press Release
[15] Written evidence – Hadlow College

Solid Oxide Fuel Cells

Fuel cells are electrochemical devices (analogous to batteries) that can convert chemical energy into electricity and heat at lower temperatures, and therefore more efficiently than combustion-based technologies in a continuous process, provided fuel and air are present. A range of electrolytes are used, of which solid oxide is one. Virtually no NOx and no SOx are produced in the process.

Fuel cells require substances that are easily oxidised as fuel. Solid oxide fuel cells can use a range of fuels including methane (CH_4), propane (C_3H_8) and carbon monoxide (CO).

At the cathode, ions oxidise hydrogen to water (H_2O) and carbon monoxide (CO) to carbon dioxide (CO_2) releasing electrons which, if connected to a circuit flow as direct current.

Plant require for the process would include an air blower and fuel compressor and other items such a heat exchanger. Commercially, cells would be connected together in a stack. The heat from exhaust gases can also be utilised.

Separation of food waste

Currently two of the 12 Kent districts and boroughs have separate collections for food waste (Tunbridge Wells and Tonbridge & Malling) which is taken to KCC's Blaise Farm Composting Facility which opened on 1 September 2008.

Evidence received from New Earth Solutions, who operate Blaise Farm In-Vessel composting facility, highlights that waste treatment operations may also provide opportunities to reduce the overall carbon impact of the processing by exploring ways to generate renewable fuel for use on site. (Blaise Farm is off-grid and currently uses diesel to run equipment).

Pyrolysis is under investigation at their facility in Poole as a method of powering generators, with excess electricity available to the grid (which in the case of the Kent facility would require extension of the transmission and/or distribution network). Also under investigation is the possibility of incorporating heat capture technology to benefit local heat-users, turning waste processing plants into CHP stations which can serve local businesses and community if located appropriately.

Further information about Blaise Farm can be found at:

http://www.deandyball.co.uk/user/files/Projects_Gallery/Civil_Engineering/Waste/Blaise_Farm/Blaise_Farm.pdf

A SEEDA funded Biofuels project[16], which ended in 2009 established the concept of a Bio-Material Handling Station where bio-material can be processed into usable liquid, sold and biogas fuels. Three potential Kent sites were identified, including one which could gather and process farm waste. One of the criteria was that materials should be available within the local area (less than 50 mile radius) and fuels should

[16] University of Greenwich – written evidence

be used within that area. The University of Greenwich are also working with ReMade SE to compare composting and anaerobic digestion of food wastes to obtain biogas.

Other types of energy from waste:

Waste wood

- In its written evidence to the select committee the Forestry Commission indicate that waste wood, such as low quality woodchips from tree surgery, site clearance and the waste stream are being used elsewhere in the South East for energy generation with prices less than £25 per tonne.

- Countrystyle Group have applied to KCC for planning permission to build a £7 million plant to generate electricity from waste wood. The wood is shredded and processed in a boiler which drives a turbine, producing enough electricity to power 6,300 homes. The plant would divert 30,000 tonnes of waste wood per annum from landfill.

- Creative Environmental Networks carried out a study for Hampshire in 2008 to compare the demand and supply of woodfuel from forestry, sawmill, tree surgery and clean waste wood, forecasting to 2026 to allow for new development and develop a strategy to develop the industry, maximise market growth and bring benefits to the county. Could a similar piece of work be of benefit to Kent?

LF100 biofuel from waste oil

- On 20th April 2010 a new 150kW combined heat and power plant will be 'unveiled' at Port of Dover. The CHP plant will be partly fuelled by waste cooking oil collected by Kent residents – 18 tonnes has been collected over a period of 14 months and the collection target for the next year is 36 tonnes.

Witnesses

Sue Barton – KCC Strategic Projects & Business Development Manager (strategic overview of energy from waste in Kent.

Dan Gillert – Living Fuels (Port of Dover waste oil scheme)

Rob Asquith - Director of Land & Planning, New Earth Solutions (Blaise Farm)

Suggested themes/questions for invited speakers are given in Appendix 2.

Appendix 1:

Glossary of terms used in this paper

AD	Anaerobic Digestion
BMW	Biogenic fraction of municipal waste
CHP	Combined heat and power
DECC	Department of Energy and Climate Change
EfW	Energy from waste (usually refers to combustion methods)
ESCO	Energy Services Company
IVC	In-Vessel Composting
KWP	Kent Waste Partnership
LATS	Landfill Allowances Trading Scheme
NOx	Reactive gases containing nitrogen and oxygen (Nitrogen Oxides)
RHI	Renewable Heat Incentive
RO	Renewables Obligation
SOx	Sulphur Oxides

Appendix 2

Suggested themes/questions for invited speakers (21st April 2010)

Questions (Sue Barton)

1. Could you tell us about national and local targets in relation to waste recycling and landfill. Are there conflicts between these targets, and those in relation to climate change and the recovery of energy from waste. How well is Kent currently performing in comparison to other authorities and what are the issues?

2. What are the key strategic and local planning issues in relation to the increased generation of renewable energy at waste processing sites in Kent, and in relation to the siting of additional plants.

3. Could you tell us about the landfill sites in Kent that currently export electricity to the grid? The Environment Agency identified three potential Local Authority sites with the potential for small scale generation (for on site use) at Richborough, Church Marshes and North Farm Landfills. Could you tell us about plans to develop these or any other such sites?

4. What are the implications of bringing 'in house' the operation of Church Marshes transfer station and waste recycling centre, with respect to targets and aims in relation to recycling and recovering energy from waste of different types? Are there plans to bring other transfer stations in-house?

5. What mix of technologies to derive energy from waste, is the optimum for Kent?

6. What do you believe should be incorporated in the Waste Development Framework, in relation to the generation of energy from waste?

7. Kent is well served by an experienced waste management team with a body of market knowledge – it is also well served by a similarly well experienced energy management team. How can these two areas of expertise come together to ensure that both KCC and Kent residents and businesses gain most from opportunities provided by various options for energy recovery from waste?

Questions (Dan Gillert – Commercial Manager, Living Fuels - Port of Dover CHP

Dan Gillert – Biographical Information

Daniel Gillert, joined Living Fuels (part of the Waste Recycling Group) from the Waste & Recycling Sector, having previously worked for Lafarge Aggregates Ltd and Sulo MGB Ltd in various commercial roles. Dan has responsibility for the securing of Used Cooking Oil and subsequent production of the proprietary fuel, LF100. Dan is married with 2 children. His interested include Golf and Running, and he will complete his second London Marathon this Spring.

1. Could you tell us about your company and about the in the Port of Dover Waste cooking oil scheme which was launched yesterday?

2. What were the drivers for the scheme and what incentives will apply to it?

3. What incentives are there for organisations and individuals to recycle used oil?

4. Please could you tell us of any advantages waste cooking oil has over other biofuels?

5. Can you tell us about the waste oil collection in Kent and elsewhere and how (and where) it is processed into LF100?

6. How much electricity can be generated from processed cooking oil and what proportion of the energy needs of Port of Dover will the CHP plant provide?

7. Can you indicate the amount of fossil fuel use/carbon that will be offset by the scheme?

8. What is the potential waste oil resource in Kent and how much energy generation it could contribute in the county?

9. Is the fuel suitable for transport use and is there sufficient available to have an impact in this sector?

10. Speaking more generally about renewable energy, can you comment on the potential for developing renewable energy in Kent and give us your views on the role of the public sector in this?

Questions (Rob Asquith - Director of Land & Planning, New Earth Solutions, Blaise Farm)

Biography

Robert Asquith has been Land and Planning Director at New Earth Solutions Group since April 2009. Previously he headed Land and Planning at Waste Recycling Group before which he was a planning consultant for sixteen years, latterly as a Director at Terence O'Rourke Ltd. Robert has worked on over ten major Energy from Waste projects as well as windfarms and has provided renewable energy policy advice for central and local government. His move to New Earth reflects the emergence of new technologies as serious players in the waste and renewable energy sectors.

1. Could you please tell us about your company and its operations, under contract with KCC, at Blaise Farm in Tonbridge and Malling District?

2. Could you explain about the current reliance on diesel at the facility and about some of the options you are exploring to reducing this reliance?

3. Could you tell us about grid connection issues in relation to the site?

4. Could you tell us something about the potential at Blaise Farm and any other sites in Kent, for utilising the heat generated in the composting process?

5. What are the challenges to be faced in terms of planning, in maximising the opportunities for generation of renewable energy and reducing the carbon footprint of such waste facilities?

6. In your experience, what are the best options available to secure funding for renewable energy and carbon reduction schemes and would any particular incentives apply to the technology?

7. Do you have any other observations about the potential for obtaining energy from waste in Kent, or about particular renewable technologies that may have an application in Kent?