



Programme Area: Bioenergy

Project: Energy From Waste

Title: Distributed Energy - Energy from Waste

Abstract:

The UK generates around 330 million tonnes of waste per annum, of which around 90 million tonnes is energy bearing. Direct emissions from the waste management sector in the UK accounted for 3.2% of the UK's total estimated GHG emissions in 2009, equivalent to 17.9Mt CO₂e. Government legislation seeks to incentivise the diversion of waste from landfill through the existing landfill tax and landfill diversion targets. In parallel the UK is committed to reducing its GHG emissions by 80% by 2050 and supplying 15% of its energy demands from renewable sources by 2020. These drivers lead to a requirement for technology solutions which enable wastes to be used as a cost effective, low carbon and indigenous energy resource for the UK. The Energy from Waste FRP was commissioned to address these requirements and identify potential opportunities for a large scale demonstration project in this area.

Context:

The Energy from Waste project was instrumental in identifying the potential near-term value of demonstrating integrated advanced thermal (gasification) systems for energy from waste at the community scale. Coupled with our analysis of the wider energy system, which identified gasification of wastes and biomass as a scenario-resilient technology, the ETI decided to commission the Waste Gasification Demonstration project. Phase 1 of the Waste Gasification project commissioned three companies to produce FEED Studies and business plans for a waste gasification with gas clean up to power plant. The ETI is taking forward one of these designs to the demonstration stage - investing in a 1.5MWe plant near Wednesbury. More information on the project is available on the ETI website. The ETI is publishing the outputs from the Energy from Waste projects as background to the Waste Gasification project. However, these reports were written in 2011 and shouldn't be interpreted as the latest view of the energy from waste sector. Readers are encouraged to review the more recent insight papers published by the ETI, available here: <http://www.eti.co.uk/insights>

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ETI Programme: Distributed Energy
Project Name: Energy from Waste
Deliverable Reference: DE2001
Contractor/Consortium: Caterpillar / CPI / Cranfield University /
EDF / Shanks Waste Management

Context

The UK generates around 330 million tonnes of waste per annum, of which around 90 million tonnes is energy bearing. Direct emissions from the waste management sector in the UK accounted for 3.2% of the UK's total estimated GHG emissions in 2009, equivalent to 17.9Mt CO₂e. Government legislation seeks to incentivise the diversion of waste from landfill through the existing landfill tax and landfill diversion targets. In parallel the UK is committed to reducing its GHG emissions by 80% by 2050 and supplying 15% of its energy demands from renewable sources by 2020. These drivers lead to a requirement for technology solutions which enable wastes to be used as a cost effective, low carbon and indigenous energy resource for the UK.

The Energy from Waste FRP was commissioned to address these requirements and identify potential opportunities for a large scale demonstration project in this area.

Project

The objective of the project is to provide the following outputs:

- Detailed analysis, characterisation and mapping of UK waste arisings to be used as the basis for the subsequent technology assessment and economic analysis within this Project.
- Assessment of the available energy from waste technologies for the whole energy value chain from waste input to power and/or heat output and identification of gaps / opportunities in this value chain.
- Identification of combinations of technologies for development and related technology improvement opportunities to fill gaps in the value chain.
- Clear UK benefits case for development and deployment of the identified technologies. The benefits will be judged against criteria agreed with the consortium at the beginning of the project under the headings of Affordability / GHG Reduction / Energy Security / Robustness

Key Project Findings

As a result of the scenario analysis and modelling work carried out by the consortium the following key points can be made:

- Applying forecast values for low to high waste availability and conversion efficiencies, the amount of useful energy from waste (both heat and power) which may be generated ranges from **5 to 230TWhrs**.
- Projected achievable electrical generation is approximately **25TWhrs per year**
- This equates to between **5% and 8%** of the UK's electricity demand

- For each of the technology and waste arisings scenarios, the deployment of advanced energy from waste technologies is projected to contribute to a net decrease in UK CO₂e emissions of between **5 and 10 MTCO₂e/year** at midpoint technology conversion and waste arisings scenarios
- Greater emissions reductions are associated with high total conversion efficiency technologies, both to electricity and from utilising heat.

A key step to fulfilling the opportunities described above is technology development in a number of key areas. Based on the testing, modelling, technology assessment and integration work carried out by the project consortium, the following Technology Development Opportunities (TDOs) have been identified:

1. The development of integrated advanced thermal (gasification and/or pyrolysis) systems for energy from waste at the community scale. City scale technology is well served by incineration and the focus on the development work should be on town and village scale technologies.
2. Cost effective gas clean-up is essential to the development of community scale advanced thermal systems.
3. Low cost, high efficiency distributed scale anaerobic digestion (AD) plants that can be integrated with advanced thermal technologies.
4. The development of community scale integrated distributed energy from waste facilities link thermal and AD technologies into highly efficient systems that can maximise resource efficiency.

The preferred approach advocated by the ETI's DE SAG and by the external reviewers consulted is for a demonstration project to focus on projects 1 and 2 highlighted above, namely an advanced thermal conversion process with integrated gas clean up system.

Further Information

Full information on the results of the project is available to ETI Members in the confidential technical report and spreadsheet economic model.