Methane to Markets Partnership Landfill Subcommittee
England & Wales Profile

Summary of solid waste management sector

Landfilling has been the main method of solid waste disposal in the UK and will remain an important disposal route for the foreseeable future. Solid waste collection is arranged by Local Authorities through competitive tendering with private waste management companies. Waste recycling and sorting may also be undertaken at this level. The waste is then consigned to waste disposal companies who operate landfills or other treatment facilities. A gate fee is charged on waste taken into these facilities. The Government imposes a Landfill Tax on deposited waste; this is levied through the gate fee.

In England & Wales the operation of waste management, including landfill, is regulated by the Environment Agency (and in Scotland by SEPA). Since 1994 operational landfills have been regulated through the Waste Management Licences that require control and monitoring of gas. After 2003, the Landfill Directive has been implemented by permitting operational sites through the PPC (Pollution Prevention and Control) scheme that already exists for other industrial processes. Sites are classified as inert, non-hazardous and hazardous; MSW goes to the non-hazardous category of site. Provision of waste management is a market driven process in which private operators make applications to build facilities. These applications are supported by a full risk assessment covering engineering, gas and leachate management. All permitted landfills in the UK are engineered with quality assured liners and caps. Most are part of a planned restoration of extractive quarries or pits, though there are a small number of landraises.

To achieve the diversion targets on biodegradable wastes set in the Landfill Directive, Local Authorities have required their waste management contractors to increase recycling and plan to use Mechanical & Biological Treatment (MBT) to deal with municipal wastes (MSW). There are several large MSW incinerators but local opposition has limited the number that contractors have built so far. Substantial amounts of residuals from these waste treatments will go to landfill.

The general policy for management of landfill gas is laid down in the Landfill Directive; gas must be controlled, collected and were possible utilised and any residual gas combusted in an enclosed flare. Environment Agency encourages operators to maximise utilisation of landfill gas. Permits applications require a risk assessment that demonstrates through modeling that there will be sufficient capacity to collect and use the predicted quantities of gas. On operational sites the Agency practices emissions based regulation. The aim is to balance the benefits to the global atmosphere from methane combustion with the local impacts of emissions from combustion of the gas. Targets on individual emissions are set on best practice and beyond the boundary of the site National Air Quality standards are applied. Operators report annually on emissions from engines, enclosed flares and landfill surfaces using monitoring guidance issued by the Agency.

Key stakeholders in the solid waste disposal sector and LFG industry

Private landfill owners – there are several very large multinationals with sites throughout the country; some of these manage their own gas utilisation and will be involved in waste collection

and treatment. In addition there are a larger number of small operators with local interests, some of these have contracts with specialist power project companies.
Public Landfill Responsibilities – waste management is all contracted. However, local authorities have responsibility for some old landfills – these are generally treated as contaminated land.
Specialist gas utilisation companies offering project management for turn-key plants or contracts to take gas to their own power generation plants beside landfills
Environment Agency – Regulator of licensed and permitted landfills and associated gas utilisation plant
Consultants designing landfill, gas collection and use and those undertaking risk assessments.
Equipment suppliers – usually agents for non-UK equipment installed by UK contractors.
Utilities – the electricity supply companies buy the power generated by the gas engines and count this against their Renewable Obligation. They do not generate this type of power themselves.
NGOs – issues are usually dealt with by local pressure groups concerned with nuisance factors associated with waste management. However health impacts from air emissions are a growing concern.

Overview of LFG potential from existing disposal sites

Typically UK landfills have capacities of several million tonnes with active tipping in cells over about 10 years. There is a legacy of old sites, generally small in size, which pre-date the present regulations. The larger landfills are in areas with a history of quarrying or mining and so are often close to major industrialised areas. Large landfills and associated gas utilisation schemes are in the South Midlands, Thames Estuary and NW England, but smaller facilities are located across the country.

The diversion of biodegradable waste will result in a lower rate of gas production from fresh waste deposits. However, previously deposited wastes continue to be a major source of methane and so gas collection and use will be needed for decades at many of the more than 1000 sites licensed to take MSW. In the UK there is an aspirational target of 85% collection efficiency on all capped landfill cells. On well-engineered sites the collection efficiency is substantially over 90% on sites with gas engines but there are other sites with much lower efficiencies. Taking account of the legacy of existing sites and the projected production from future waste deposits the total amount of methane emitted by UK landfills is estimated to be around 500 Kt/a but could fall substantially to a third of this by 2020. Some of this could be collected and used at a higher cost than currently incurred. However, a proportion of this gas cannot be collected economically because it is of low calorific value or the flow is poor or unreliable. Nevertheless, some of this must be combusted (e.g. in enclosed flares) to minimise nuisance from odour.

The move to totally contained landfills in the 1980s meant that collection and combustion of gas became a necessity on some sites to control odour problems. It was not until that introduction of the NNFO (Non-Fossil Fuel Obligation) scheme that utilisation of gas for power generation became economically attractive. The latest Renewabales Obligation Certificates (ROC) means that power generated from landfill gas commands a price up to three times that generated from fossil fuel. As result, over the past 2 years, there has been a substantial increase in the number of power generating units running on landfill gas. It is estimated that the installed capacity of gas

engines in the UK (mostly in England) is 600MW, though the sustained power production is estimated to be around 400MW electrical. The number of sites and number of units at each site is increasing steadily. The capacity is located at 254 landfill gas power stations (several sites have more than one station). The eleven largest sites each have between 20MW and 8MW installed power generation and represent almost a quarter of the total installed capacity. About 100 power stations have a capacity of 2MW or less. The engines may be operated by the landfill company or by a specialist renewable power company who buy and collect the gas for engines adjoining the site. The majority of gas utilisation is through spark ignition engines, operated beside the landfill. These generate electricity through 1MW modular sets and the output goes directly to the National Grid. The proximity principle means that many large sites are close to urban centres so the power from landfill gas is easily distributed.

All new sites taking non-hazardous waste will have gas collection and so there will be a continued steady increase in capacity as cells in these sites are filled and capped. However, the annual rate of increase in gas will slow and may have peaked within a decade. There are some old sites where gas collection can be improved to run small engines but the driver may be regulatory rather than economic since the costs will be higher than on newer, larger sites. At other locations the cost of installing collection may be very high or the old site engineering means that gas flow is unreliable or of poor quality. These very old, small sites may be outside the existing license and permitting regime.

Landfill licences (and responsibility for the site) can only be handed back when a site is biologically, chemically and physically stable. Until then an owner has to make financial provision to cover remediation and monitoring. The end of gas production is normally a good indicator of completion but demonstrating this requires a complete monitoring record. It is anticipated that useful gas production may continue on existing UK sites for several decades, albeit at a reducing level after 2010.

List of existing or planned landfill gas capture and/or use projects.

ETSU, on behalf of the Government, has published guidance on installation of a reliable gas utilisation plant of UK landfill. Current UK practice for control, collection, utilisation and flaring of landfill gas is contained in recent Guidance published by the Environment Agency (LFTGN 03 Guidance on the Management of landfill gas). This requires an holistic approach to gas management in which all emission pathways are considered and risks from over-extraction (e.g. landfill fires or odours) are minimised. The majority of LFG utilisation schemes in the UK are electrical power generation, supplied to the national grid under NFFO or ROC agreements with power utilities. A few small schemes supply local requirements at sites. There is almost no direct use of landfill gas.

Generally the scheme is implemented on a fully contained landfill with permanently installed gas wells, regularly balanced and monitored. The collection pipework is normally within the permitted site leading to a compound on stable ground close to the edge of the landfill. The power station compound generally has a number of modular spark ignition engines with vertical exhausts (ca emission point 6m from ground). The NOx emissions from large groups of engines with short exhaust stacks may be unacceptable in Air Quality Action zones and so taller stacks (e.g. 30m) or dispersal of engines may be necessary.

Typically the stations use 1MW (electrical) sets but recently 0.3MW sets have been used to maximise power extraction as the gas supply rises progressively. The larger renewable power companies can move engines between sites to achieve the best use of available gas as supplies change. The larger stations have several 2.5MW engines in dedicated buildings with tall emission stacks. Each compound will have a balancing flare that may also provide back-up during engine shut down. All landfill gas flares in the UK must be fully enclosed. Emissions from the engines and flares must be monitored for NOx, CO, VOCs and NMVOCs. Power is sent to the grid by a dedicated connection, the cost of which is charged to the operator. The visual impact of these power stations, particularly if tall stacks are needed, may be a planning issue for the Local Authority.

Challenges and/or priorities to greater LFG recovery and use:

The UK landfill gas utilisation sector is a mature industry and there are no significant legal or institutional challenges. Regulations on emissions constrain the use of combustion processes for landfill gas and place a financial burden on operators. However, a Regulatory Impact Assessment has demonstrated that the requirement to monitor and meet emission standards is more than balanced by the benefits that result from this (e.g. improved air quality).

The main challenges in the UK are long term technical issues.

1. Using the remaining emissions of landfill gas methane will require technology to recover energy from low quality, variable flow or smaller quantities of gas.
2. Increasing the lifetime of gas collection systems (e.g. preventing loss of efficiency in wells) may be an issue for the long-term viability of some locations.
3. Controlling gas generation to get stable usable supplies for a long period and minimising the unusable emissions in later years (e.g. use of leachate management)
4. In order to minimise the local impact of power generation it is important that emissions are further reduced. There is a need to find units with very low NOx emissions for locations close to sensitive receptors such as houses.
5. Lower cost methods of monitoring input gases and emissions in a reliable and representative manner are needed to reduce the regulatory burden needed o ensure a balance between global benefit and local impact.

Market assessment and reform issues:

1. End use for LFG is almost all through electricity generation for the national grid. There are a few trail uses of methane enrichment to power collection vehicles.
2. ROC arrangements ensure that there are financial arrangements to make landfill gas use economic.
3. There are multiple suppliers and so competition is strong
4. Market access – there have been claims that access to the grid is too costly but this has been addressed by Government. The Grid is designed to distribute power to remote locations and so there are some technical issues with re-configuring it to accept relatively small inputs from these locations.
5. Carbon credits – not yet clear what impact these will have
6. Renewable or green energy standards are being met through the ROC scheme

Financing Options

1. There are currently financial incentives for renewable power – these have had a significant benefit in maximising methane capture and use with an associated reduction in nuisance from uncontrolled emissions of raw gas.
2. Most schemes are internally funded by the operators – smaller operators have agreements allowing specialist gas utilisation companies to take the landfill gas for use in an adjoining compound

Current cooperation among countries (e.g., existing bilateral agreements or grants)
None
Individual UK consultants are involved in schemes in Developing Countries.

Wish List": What are you looking for from the Methane to Markets Partnership (e.g., financing, technical assistance, feasibility assessments) and/or what expertise can you provide to the Partnership?

- Looking for channels for using UK experience and collaboration on the technical issues of using poor quality gas and reducing NOx emissions.
- UK consultants and engineers can transfer the experience gained in building and running successful schemes in the UK
- UK regulation has successfully balance beneficial use with acceptable environmental impact of gas utilisation

Conclusions and observations

UK has a well developed landfill gas utilisation industry. The financial instruments encourage utilisation and a strong regulatory framework minimises local impacts while achieving significant methane gas emissions.

References and sources (e.g., appendices, supplemental information)

1. www.environment-agency.co.uk for technical Guidance; Details at http://www.environment-agency.gov.uk/business/444217/444663/landfill/477943/?version=1&lang=_e
2. www.defra.gov.uk – Government department responsible for environmental issues including waste management and global warming issues
3. www.r-p-a.org.uk for details of Renewable Power installations
4. www.esauk.org, – Environmental Services Association – the trade body for waste Management
5. www.ciwm.co.uk – the Chartered Institute for Waste Management provides training information.

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