



**Assessing, Capturing and Utilising Methane
from Expired and Non-operational landfills**



**An EU LIFE+ project
for 2012-2015**

An overview of the ACUMEN project report and tools

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LANDSS Landfill Aftercare Forum, 21st October 2015



LIFE11 ENV/UK/000402



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*Our goal was to demonstrate approaches to
managing methane gas and reducing methane
emissions at closed landfills.*



Headline findings - *generating energy*

- Flaring (or previously-flaring) sites are best-placed to generate energy, due to existing infrastructure being in-situ (electricity & landfill gas).
- Small-scale spark-ignition engines (c.150kW) can generate ≈ £50,000 p.a. (current UK prices).
- Micro-scale engines (18kW combined) can generate ≈ £9,000 p.a. (current UK prices).



Headline findings - mitigating methane emissions

- Low-calorific flaring is possible down to 8% methane, with savings of \approx £9,000 p.a. possible (Reduced power use).
- Low-calorific flare emissions are comparable to 'standard' flare emissions (UK).
- In-situ bio-oxidation of methane using a biofilter can achieve methane removal rates of 90% .
- Whole-surface biofilter emissions can be accurately monitored and measured.



ACUMEN

demonstration sites



0 146km

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Sugden End closed landfill, near Keighley



Headline findings

- A 150 kW engine running on landfill gas at a methane content of 42% at LFG flow of $86\text{m}^3 \text{ hr}^{-1}$ can generate **≈ £4,000 per month** based on current UK energy generating incentives (0.2 ROCs).
- Most closed sites with existing LFG infrastructure will be able to export energy <50kW.
- Upgrading of the grid connection may be needed for >50kW.

Docking 2 closed landfill, near King's Lynn



Headline findings

- Two 9kW Stirling engines (total of 18kW) with LFG flow rate of $25\text{m}^3 \text{ hr}^{-1}$ @ 30% CH₄ can generate **≈ £750 per month from power sales** based on current UK energy incentive rates (1.9 ROCs).
- The Stirling engines generated >100,000kwh of electricity from >150,000m³ of landfill gas during the demonstration (18 months).
- The engines also produced 230,000kW of useable heat for biomass drying.

Otterspool former landfill, Liverpool



Headline findings

- The low-calorific flare can combust landfill gas across a wide range of LFG flow rates, and with methane concentrations down to 8%, without support fuel.
- UK emissions standards were met throughout the demonstration period (15 months – 6 tests).
- Significant costs savings can be realised by be downsizing gas extraction equipment –
≈ £9000 per year @ the Otterspool site

Strumpshaw closed landfill, Norfolk



Headline findings

- Up to 90% methane removal can be achieved at older landfill sites, where both landfill gas flow and methane concentrations are low.
- Performance is particularly good in terms of methane removal at concentrations of 5 - 10% at flow rates of $45\text{m}^3 \text{hr}^{-1}$.
(Maintaining $\text{O}_2 : \text{CH}_4$ ratio is key!)
- A prototype flux sheet was used to successfully demonstrate whole-surface methane flux measurement.

Maesbury Road closed landfill, Oswestry



Headline findings

- Bio-oxidation can be achieved using modular units, with up to 80% methane removal achieved.
- These units require very little supporting infrastructure other than a water and electricity supply.
- Monitoring and reporting performance is straightforward and can be achieved with low levels of resource and technical input.

The ACUMEN Project Report



The ACUMEN project report

- The project report provides advice to people who are responsible for managing the gas at closed landfills.
- The advice is based on our learning and experience during the ACUMEN project and is presented to help closed landfill site owners identify the most suitable approaches to managing the landfill gas at their site(s).
- This report is *not* exhaustive or a detailed 'how to' guide for managing closed landfills.
- We envisage that people will simply go straight to the topics that are of greatest relevance to them.



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The ACUMEN project report – Outline

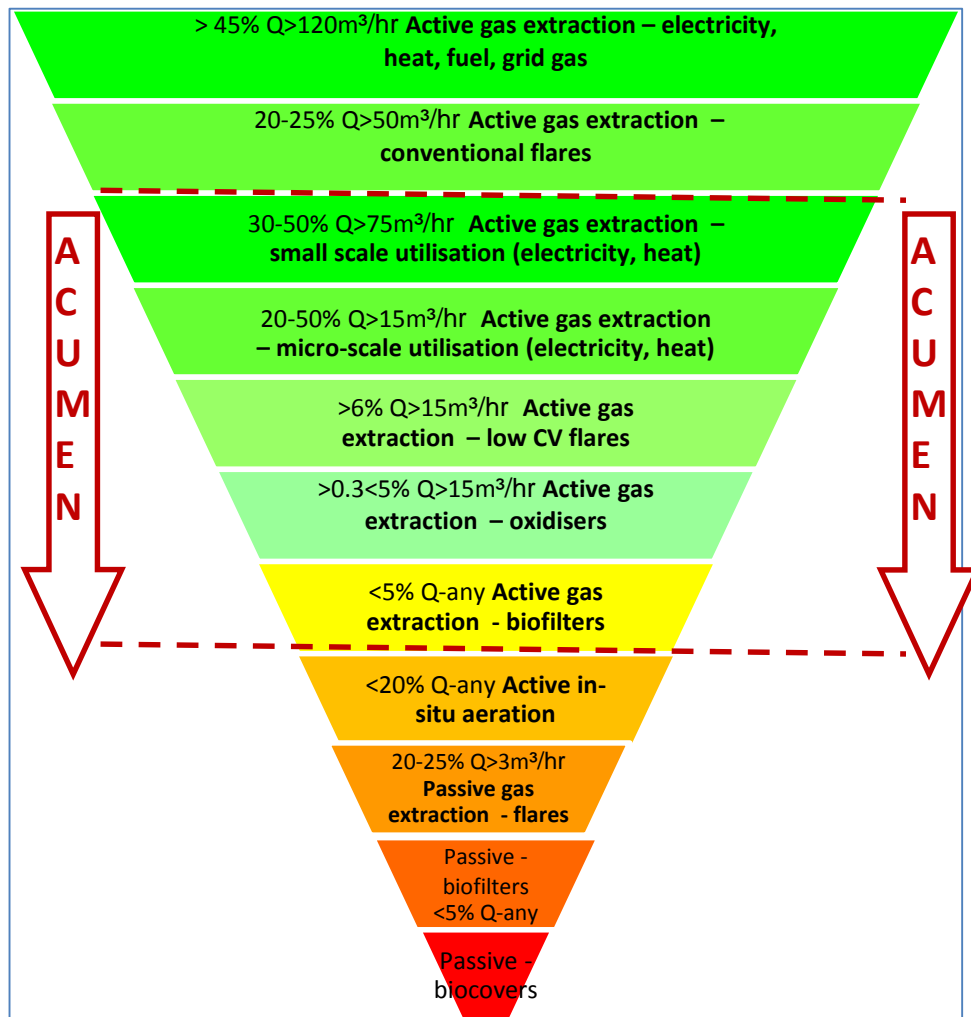
The report is split into three sections – These are:

- Chapters 1 to 3 cover topics relating to ***Assessing*** the gas at your closed site(s).
- Chapters 4 to 6 deal cover topics relating to ***Managing*** the gas at your closed site(s).
- Chapter 7 presents details of the work at our five UK demonstration sites. ***This will help you decide if your sites are similar to our demonstration sites.***



ACUMEN landfill gas management hierarchy

- We have modified a LFG hierarchy, and have focused our ACUMEN work on the sections shown.
- This figure is used frequently in the report, and helps match gas parameters to a management option.



The ACUMEN project report – Chapter 1

- Chapters 1 is intended to help address the statement;
I am responsible for a portfolio of closed landfills and would like to get a feel for the likely gas management and whether any of my sites might have the potential for power generation.
- This chapter introduces the ***Portfolio Screening Tool***.
- This chapter is primarily aimed at people who may have a limited knowledge of their portfolio of closed landfills -
If you already have a good knowledge of your sites, skip forward.

The ACUMEN project report – Chapter 2

- This chapter is intended to help you answer the question;
I think one of my closed landfills may have enough gas to support some form of power generation scheme - What do I do next?
- Chapter 2 describes what data you need to use our ***Gas Estimation Tool*** and what the tool can tell you.
- This spreadsheet-based tool allows you to quickly estimate how much gas your closed landfill may be generating.

The ACUMEN project report – Chapter 3

- Chapter 3 focuses on Monitoring;
I'd like to do some monitoring to confirm my understanding of the amount of gas being generated and surface emissions at my site. What techniques could I consider?
- This chapter presents the innovative techniques available to help improve your understanding of the gas generation and surface emissions at your sites.
- This chapter does *not* include an exhaustive list of traditional monitoring techniques.

The ACUMEN project report – Chapter 4

- Chapter 4 could be helpful if you are considering the question; *I am managing an older closed landfill with decreasing gas volumes and methane concentrations – What are my options?*
- Chapter 4 highlights the approaches to managing gas, focused on during ACUMEN. (Such as; small scale internal and external combustion gas engines, low calorific flaring and active bio-oxidation)
- In this chapter we have attempted to match gas flows & quality to potential gas management techniques.

The ACUMEN project report – Chapter 5

- *Changing the way I manage gas at my landfill will have financial implications. What costs, benefits, risks and issues might I need to consider when developing a business case for changing my current gas management approach?*
- Chapter 5 is intended to help people work through some of the issues when considering developing an economic case for changing the way you manage the gas at your site.
- Where possible, we have tried to include indicative values for the costs based on the project's experience.

The ACUMEN project report – Chapter 6

- This chapter could be helpful if you find yourself asking the question; *I'm thinking about changing the way I manage gas at my site. What are the regulatory issues I need to consider?*
- Chapter 6 looks at planning/ environmental Regulation and grid connections for exporting electricity.
- If your chosen gas management option involves electricity generation for export, then the section on applying for a grid connection could be particularly relevant to you.

The ACUMEN project report – Chapter 7

- This chapter provides background information and detail about each of the demonstration sites, and the demonstrated gas management technologies?
- Chapter 7 aims to help you answer the question:
Is my site like this?
- If the gas conditions and infrastructure at the demonstration sites are similar to your site, you may be able to replicate a similar utilisation or mitigation technology.



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Questions?

