Landfill biogas quick scans and future utilization
Overview

- Introduction
- Quick scan methodology
- Quick scans in Spain
- Results
- Conclusions
- How to utilize LFG after a quick scan?
- Questions
Introduction

Gastreatment Services BV

- Engineering and consultancy company
- Field of expertise: biogas
- Design and manufacture biogas utilization and purification systems

- 35 employees
- Turn over € 3.5 million 2009

- Involved in BIOGRID (Life) project in order to upgrade biogas to natural gas quality in Spain
Introduction

*Why quick scans?*

- Landfill operators are obliged according to the EU Landfill directive (LFD) to extract landfill gas to mitigate GHG’s

Landfill operator LFG treatment options:

- Flaring
- Boilers
- Co generation or
- Upgrading

- Flaring is a necessity (LFD)
- Utilization of LFG decision is based on economical feasibility
Introduction

*LFG production*

There are multiple options to verify LFG production at a landfill:

- Pump tests
- Modelling
- Emission measurement

- First two options are cost effective solutions when combined
- Emission measurements are costly and need to be performed on a regular basis

Combination of both pump test and model run give more insight in future development of the landfill with respect to LFG production and future utilization.
Introduction

LFG production

- SUSPENDED SOLIDS
- Hydrolysis
  - sugars
  - amino acids
  - long chain fatty acids + glycerol
- Acidogenesis
  - intermediary products (organic acids and alcohols)
- Acetogenesis
  - acetate
  - hydrogen
- Methanogenesis
  - methane
Introduction

LFG production

Variabilities in LFG production are mainly caused by:

- Waste composition
- Age of waste
- Presence of oxygen
- Moisture content
- Temperature
Quick scan

Methodology

• Pump trails at different gas wells
• Time trial 2 hours per well
• Start pump and adjust extraction flow until LFG quality stabilizes
• Monitor and record gas quality and flow
• Take samples of biogas for laboratory verification

• Pump set up
Quick scan

Methodology

Every 15 minutes the following information is recorded:

- Time
- Atmospheric pressure
- $\text{CH}_4/\text{CO}_2/\text{O}_2/\text{H}_2\text{S}/\text{CO}$ concentrations
- Discharge pressure
- Flow

After sampling, biogas will be sent to KIWA laboratory for analysis on:

- $\text{CH}_4/\text{CO}_2/\text{O}_2/\text{H}_2\text{S}/\text{CO}$ concentrations
- Calorific value
- Density of landfill gas
Quick scan

Methodology
Quick scan
Vascontainer Irun April 2010
Quick scan Vascontainer landfill

Case study

Vascontainer landfill characteristics

- In operation since 2002
- 18 ha in area
- 947,000 tonnes of waste in place (2009)
- Waste composition dominated by contaminated soil and construction and demolition waste (low carbon content)
- 6 vertical gas extraction wells installed
Quick scan

Urteta landfill February 2010
Quick scan Urteta landfill

*Case study*

Urteta landfill characteristics

- In operation since 1989
- 10 ha in area
- 780,000 tonnes of waste in place
- Waste composition dominated by municipal solid waste
- 4 vertical gas extraction wells installed

- Plan to develop 30 gas extraction wells in the future
Utilization after quick scan

Credit crunch before

- Highest oil price ever
- Awareness of fossil fuel dependency went up
- Landfill operation – 'business as usual'

Credit crunch after

- Cradle to cradle thinking – waste is a commodity
- Decline in waste production
- Landfill operation – 'not business as usual'
- LFG relatively cheap to obtain/recover and utilize
Upgrading technology

*Cryogenic upgrading benefits*

Energy efficiency is high

- Methane loss is low (0.5%)
- Both BMG and LBG production possible
- Liquid CO$_2$ production, enabling utilization at:
  - Greenhouses
  - Conditioned transport

- BMG production feed into local natural gas grid
- LBG is a high density fuel, and makes transport possible
  - Remote landfills, flaring not longer only option
Process flow GPP®-systeem
LFG upgrading to BMG
CO₂ removal

Phase diagram
Process flow GPP®-systeem
LFG upgrading to BMG
Process flow GPP®plus-system

LFG upgrading to LBG
Conclusions

Future developments

At WWTP’s

- November commercial LBG plant in operation (120 Nm$^3$/h)
  Sundsvall Sweden – Public transport buses run on LBG

- Q4 2010 second LBG plant in operation (475 Nm$^3$/h)
  Loudden, Sweden

At landfills

- 2011 – Haarlem The Netherlands - production of LBG out of LFG

- Aim 2010 – 2012 2 additional landfills
Thank you for your attention

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