

Why do actual Landfill Gas flows differ from CDM Modelling?



Presentation by Graeme Alford
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The earth is coping with a crisis

- Atmospheric Carbon Dioxide (CO_2) is now at 385 parts per million (ppm)
- Rate is increasing at 20ppm per decade & accelerating
- Methane (CH_4) is 23 times more damaging than CO_2
- Landfills contribute 3% of CH_4



Landfill Gas Flows are Falling Short of CDM Modelling

- Is the modelling flawed?
- Are the design parameters correct?

OR

- Are the constructed facilities not being properly managed?



Australian Garnaut Report on Global Warming (2008)

- Climate change is human induced
- Global emissions are now exceeding previous predictions for 21st century
- India and China are expanding
- Fossil fuels of oil, gas and coal dominate the global energy mix



Australian Garnaut Report on Global Warming (2008)

- Moving more rapidly toward high risk levels of CO₂ concentration
- Desired maximum CO₂: 450ppm
- Most developed countries must reduce their emissions by over 80% below 2000 levels by 2050
- Australia is at 94% reduction



Australian Garnaut Report on Global Warming (2008)

Country	Annual emissions (tonnes/person)	% cuts on current levels by 2050
Malaysia	37.4	95
Australia	26.6	94
Canada	24.4	93
United States	23.4	93
China	3.8	55
India	1.5	-13
World	7.3	



Australian Government Action

- Emissions Trading Scheme, badged as “Carbon Pollution Reduction Scheme”
- Cover stationary electricity generators, transport and “waste” sectors
- “Cap & trade” format





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All major landfill operators are able to contribute to reducing the effects of global warming by capturing the methane gas generated by their landfills and destroying it



Qn 1: Is the Modelling Flawed?

- Modelling provides a good estimation of the potential gas flows
- Rule of thumb (for engineered landfill):
1 million tonnes (waste) = 1MW (electricity)
- Possible to get more gas/electricity than this rule of thumb/benchmark
- First Order Decay Models used
 - US EPA model or UNFCC type
 - decay rates & local assumptions

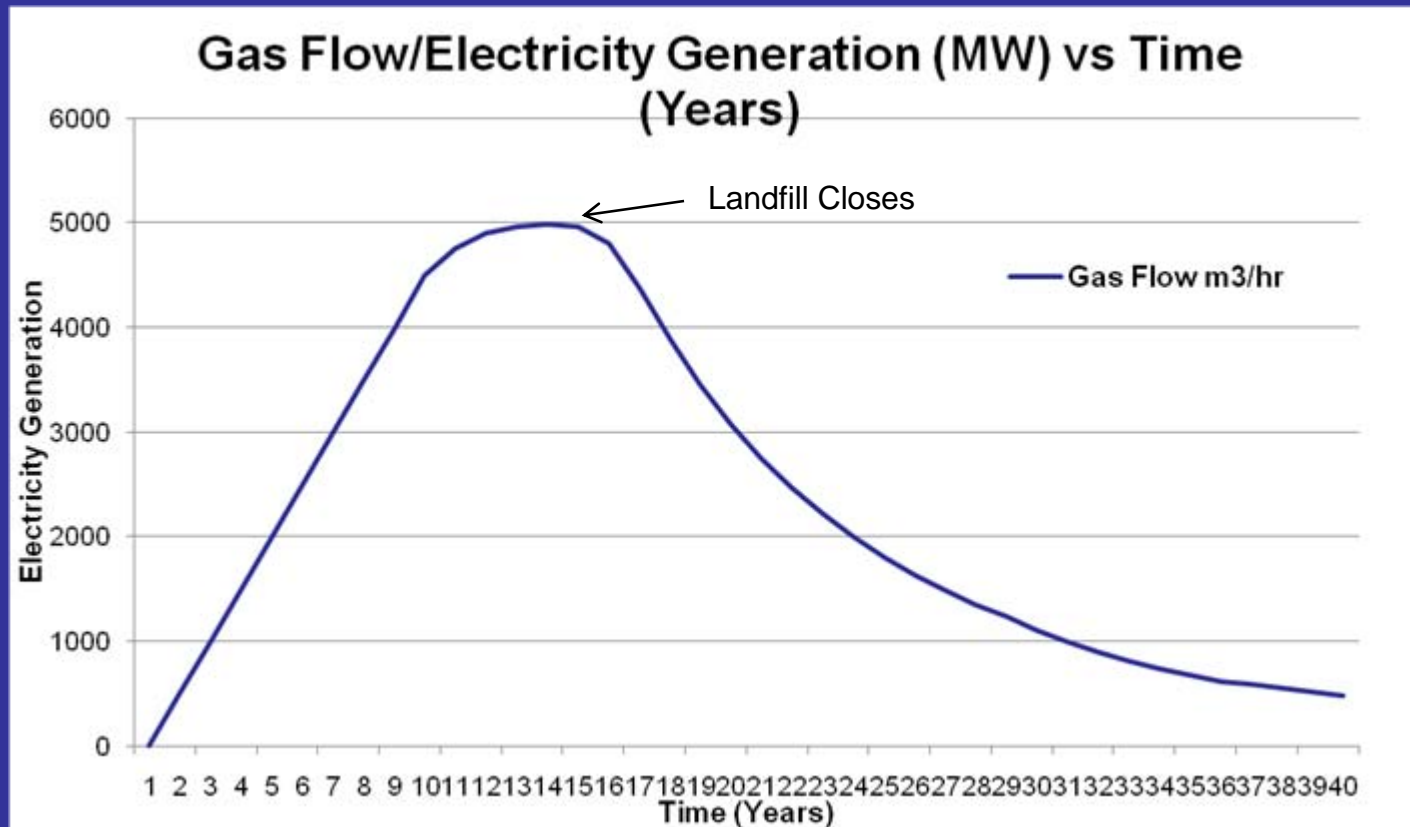


Desired Minimum Criteria:

- Waste in Place: 1 million tonnes (Minimum) of organic waste
- Closed Landfills: 2 million tonnes (Minimum) and not more than 3 years old
- Operations: Compaction/cover /capping
- Water: Drained base/leachate control
- Depth of waste: 6m, 10m or 20m
- Dump sites: Avoid if possible



Gas Production over Time

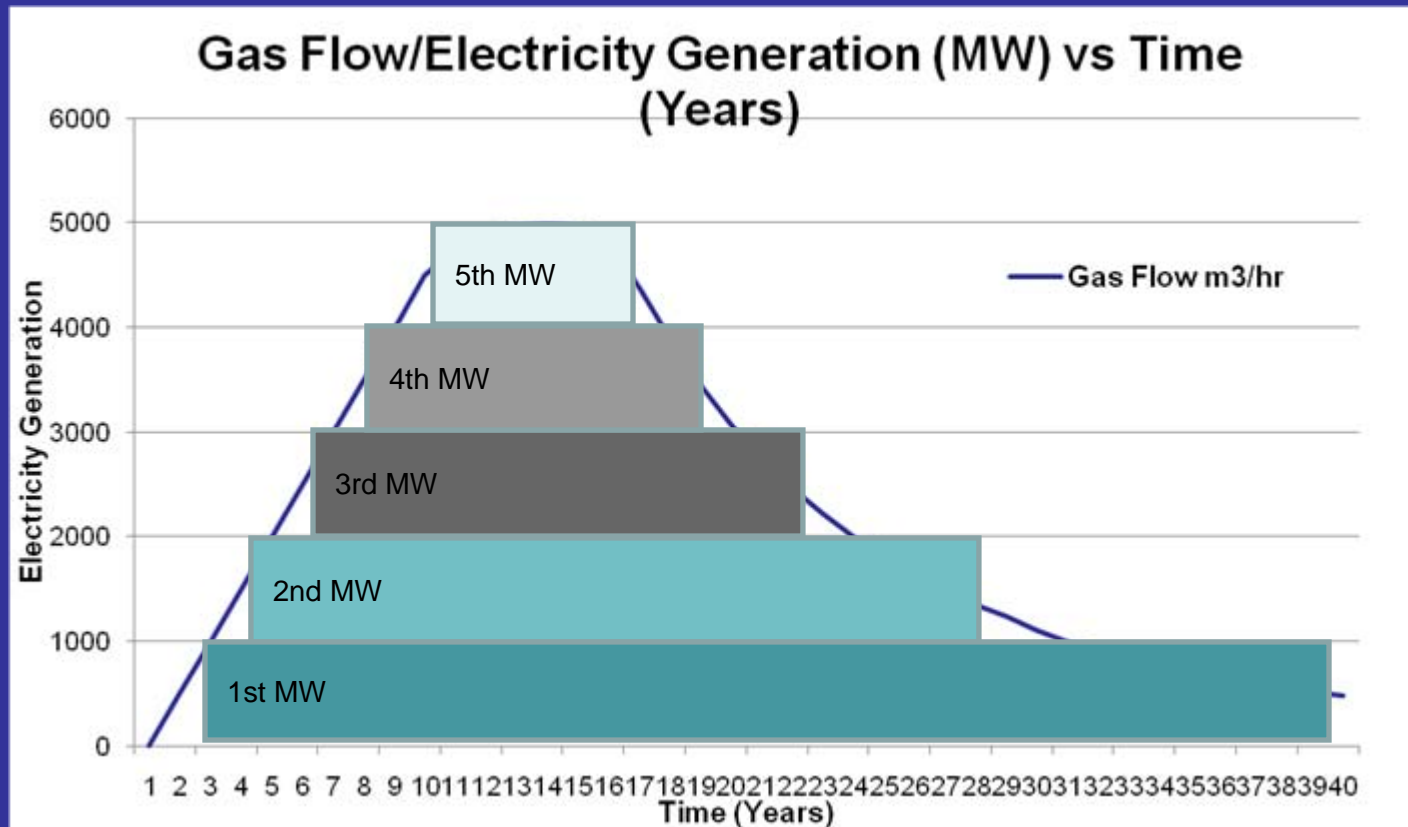


Larger Landfills



- Generation of green/renewable electricity
- Income from electricity sales and CERs (CDM)

Electricity Generation over Time



Smaller Landfills



- Flare gas
OR
- Generate electricity for internal use
PLUS
- CER (CDM)
Income

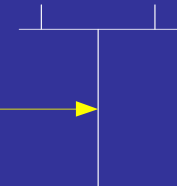
Qn 2: Landfill Gas System Design



Landfill Wellfield
Gas Extraction
System

Gas
Pre-treatment
Plant

Power Station



Flare





Landfill Gas Capture System

- Series of vertical wells on a grid layout
- Drilled after completion of capping works
- Use horizontal wells on active cells



Wellfield Design Parameters #1

- Waste composition and moisture content
- Landfill operations
 - Compaction rates
 - Cell construction
 - Age of waste



Wellfield Design Parameters #2

- Surface area & side slopes of landfill
- Depth of waste
- Type of final cover



Wellfield Construction

- Spacing, depth and location of wells
- Perimeter manifold
- Management of condensate/leachate
- On going “Wellfield Monitoring Regime”



Gas Pre-Treatment Plant

- Prior to combustion, gas is cleaned to meet engine manufacturer's requirements

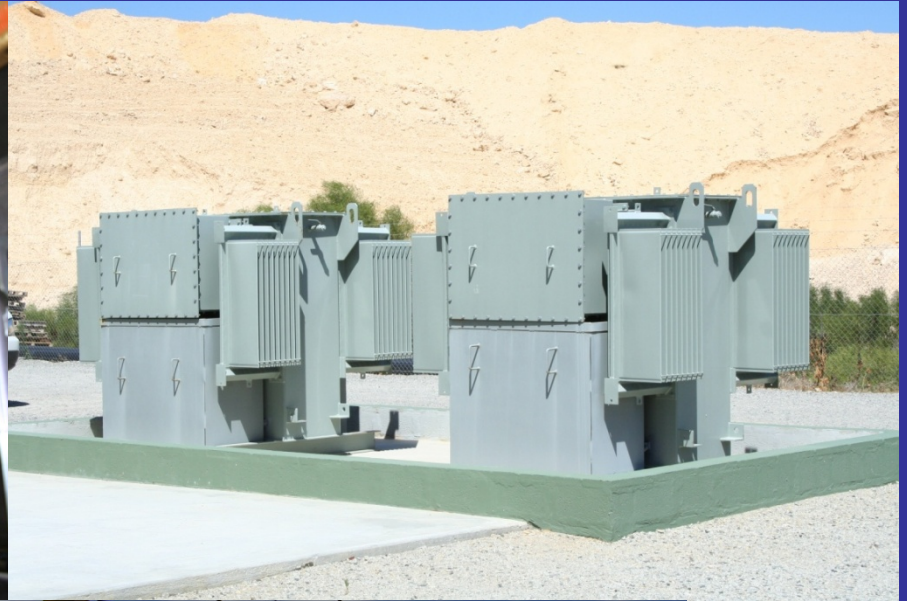


Electricity Generation

- Gas is combusted to generate electricity in engines designed for landfill gas



Electrical Equipment



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Flare System



- Required in event of power station being in-operative
- Environmental/CDM licence requirement
- Operates independently
- Regularly tested

Qn 3: Gas Systems Operations

- Gas recovery systems are dynamic
- Require constant monitoring
 - Wellfield and manifold
 - Condensate/Leachate Management
 - Fugitive Methane emissions
 - Remote Monitoring
- Monitor gas flows and evaluate
- Modify systems when required



Wellfield Monitoring

- Regular inspection of wellfield and manifold system
- Measure gas flows and gas quantities at individual wellheads
- Adjust flow rates accordingly



Managing Condensate/Leachate

- Condensate collected in gas extraction wells & manifold is removed as leachate
- Leachate re-circulated into landfill or treated



Fugitive Methane Emissions



- Monitor for fugitive landfill gas emissions
 - Dying or dead vegetation
- Take corrective action to minimise

Remote Monitoring



- Operations monitored from a remote central location
- On site personnel required for well field monitoring
- Routine maintenance works undertaken locally



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e.g. flares, pre-treatment
plants, engine gensets
- Construction of
Wellfields and/or flares



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- Landfill gas capability assessment service
- Design and project management services
- Trouble Shooting of existing landfill gas facilities performing below expectations





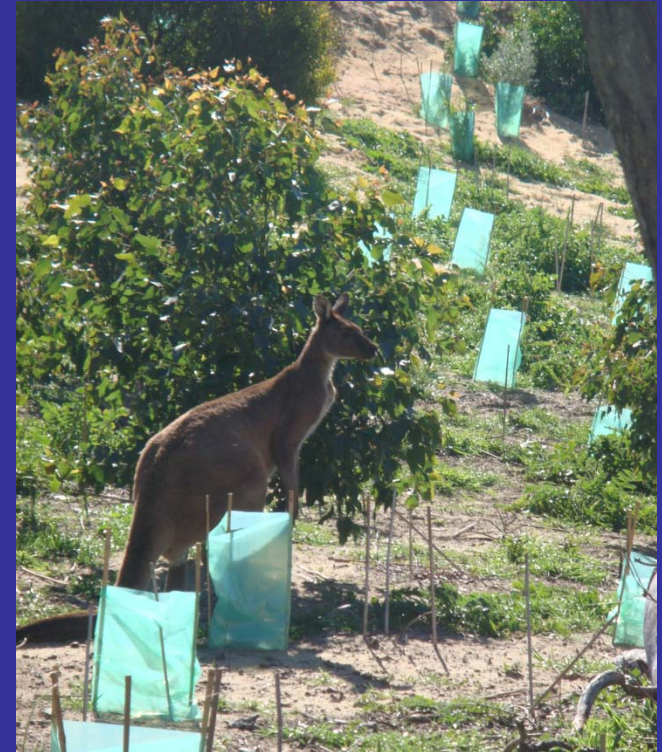
Conclusion - General

- Recognised our planet is changing from human activity
- Global warming is now on the agendas of Governments and Companies
- Immediate action is required to reverse the greenhouse gases emission trends (ETS)
- Copenhagen Outcomes



Conclusion – Landfill Gas Systems

- Use proven systems
- Wellfield constructed as soon as possible
- Art in managing gas extraction – efficiency
- Station capacity based on gas flows
- Leachate management



Conclusion - Landfills

- Landfill operators have an obligation to operate their landfills in an environmentally sustainable manner
- Collection and proper disposal of the landfill gas generated is a pre-requisite
- It offsets the need for additional black electricity generated from fossil fuel products (Double Benefit)



Untapped Potential of Landfill Gas

*“Landfill gas control is the low hanging fruit.
The technology is available, requires little
investment and can be implemented quickly.
Once it is installed it does not require
continued waste acceptance.
It therefore does not frustrate the transition
towards a recycling society.”*

**Heijo Scharff, Secretary General,
(EU) Sustainable Landfill Foundation**



Thank You. Any Questions?

