



## A waste-to-energy success story:

- delivers proven environmental benefits at low cost to the community
- reduces greenhouse pollution by more than 4 million tonnes of CO<sub>2</sub>-e each year
- distributed generation of 850 gigawatt hours of renewable energy every year
- produces 10% of all Renewable Energy Certificates
- saves more than 1.6 billion litres of water each year
- supports investment of over \$500 million in Australia
- creates jobs throughout regional and urban Australia

**Base-load renewable energy from organics**  
Innovation in Australia's green electricity industry



# Renewable Energy + Emissions Reduction

## Innovation & investment

The landfill gas industry is a quiet achiever in Australia's renewable energy sector, based on over 50 grid-connected, distributed energy generators operating around the nation, and with many innovative projects under construction or in development.

Currently over 300 people are directly employed in the industry with several hundred indirectly and this is set to significantly increase to provide hundreds more 'green-tech' jobs in regional and urban Australia.

The landfill gas power generation industry already has invested more than \$500 million in Australia building 850 gigawatt hours (GWh) per year of generation capacity and associated infrastructure, and is forecast to be a substantial contributor to Australia reaching its new 20% renewable energy by 2020 target.

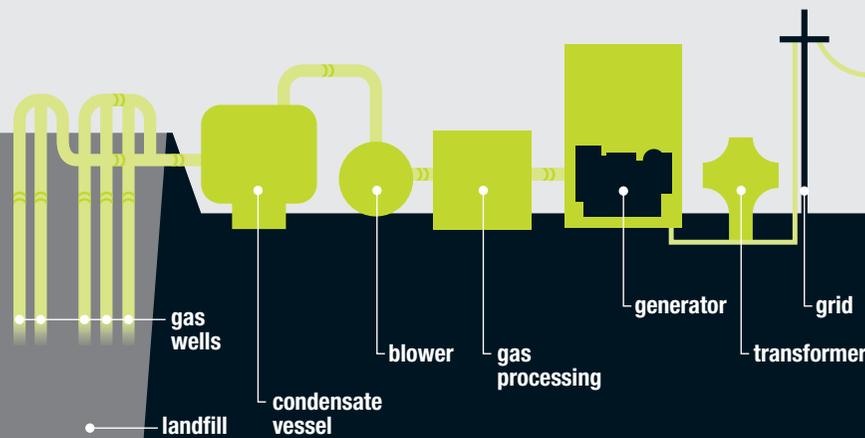
The world-leading technology developed by Australian companies provides the most effective means of capturing the energy potential from organic waste, whilst achieving real environmental outcomes at low cost to the community.

## Biogenic energy from waste

Landfill gas is a form of renewable biogenic energy derived from the decomposition of the organic component of waste deposited in landfills. The process of microbial degradation under anaerobic conditions releases the energy stored in organic matter as methane. Through the biological conversion of organic waste to methane, the solar energy harnessed in photosynthesis is released into readily useable biogenic energy.

In composition, landfill gas is mainly a mixture of carbon dioxide and methane. In addition to being biogenic energy, methane is the cleanest burning of hydrocarbon fuels, and power generation from landfill gas harnesses the methane to produce electricity.

Landfill gas collection, treatment and conversion process



## Carbon pollution reduction

In Australia, the use of landfill gas to generate electricity achieves emission reductions of about 5 tonnes for every megawatt hour (MWh) of electricity produced. This is achieved through the recovery and destruction of methane, displacing fossil-fuelled generation (mainly black or brown coal).

According to the Australian Greenhouse Office, excluding land use change, waste has been the only sector to date that has actually reduced emissions from 1990 levels (13% reduction).

In fact, recovery and use of methane from landfills for electricity generation has made a significant contribution to Australia being able to meet its Kyoto greenhouse target for the first commitment period (2008-2012). Landfill gas power generation is responsible for the reduction of over 4 million tonnes of greenhouse gas emissions each year. The technology is so successful that it is now utilised for power generation from waste coal mine gas, resulting in even greater carbon pollution reduction.

The industry is a carbon trading pioneer, with its emission reductions having traded in early voluntary and mandatory carbon markets through accreditations under the NSW Greenhouse Gas Abatement Scheme (GGAS) and the Australian Government's Greenhouse Friendly program.

## Case Study: Lucas Heights Renewable Energy Facility

The power generation facility is owned by Energy Developments and consists of a series of internal combustion engines with a capacity of 22MW.

The project is located at the Lucas Heights Landfill in New South Wales, 23 kilometres south west of Sydney.

The project was commissioned in 1998 and is the largest landfill gas power generation facility in Australia.

It is grid connected with the power sold to the local electricity retailer.

Lucas Heights Renewable Energy Facility



## Reliable base-load electricity

Landfill gas power generation produces reliable base-load electricity, which reduces dependence on fossil-fuelled electricity – decreasing both greenhouse gas emissions and water consumption. Because landfill gas generators are connected to the local distribution network, and produce distributed electricity close to where it is consumed, electricity losses and network expenditure are also minimised.

During 2008, Australian landfill gas power plants produced approximately 850GWh of base-load renewable electricity, with renewable electricity generation from landfill gas currently powering up to 400,000 homes on a continuous basis, making the industry an early mover for the orderly transition to a low-carbon economy by 2050. Landfill gas-fired generation has created over 10% of all Renewable Energy Certificates (RECs) under the Australian Government's original Mandatory Renewable Energy Target (MRET) since its introduction in 2001.

The benefits achieved by landfill gas power generation are immediate, sustainable and cost effective. Power generation from landfill gas represents the largest contribution and least-cost manner of carbon pollution reduction from the waste sector.

Modern landfills are highly engineered facilities and typically consist of well defined cells that are lined with hi-tech membranes to protect the surrounding strata and optimise the collection of landfill gas, ensuring maximum electrical output. The efficiency of modern landfills is proven to surpass that of alternative waste treatment technologies for electricity generation and exports far more renewable energy per tonne of waste.

*Internal combustion engine*



## Combining renewable energy and emissions reduction

The most successful technology to convert municipal waste to energy in Australia has been the capture and use of landfill gas to produce electricity. Capturing the gas and converting to renewable energy is resource recovery in its purest form with a strong market for the product.

An important environmental consequence of landfill gas electricity generation is the decrease made to greenhouse gas emissions. While the sun, wind and water provide sources of renewable energy and a replacement for fossil fuels, landfill gas power generation is unique as it also destroys an existing pollutant in the process.

The landfill gas industry has responded strongly to government initiatives to support carbon pollution reduction and renewable energy. Landfill gas generation produced approximately 600,000 Renewable Energy Certificates (RECs) in 2008 under MRET, accounting for over 10% of all RECs produced. It also produced over 20% of Greenhouse Abatement Certificates (NGACs) under the NSW Greenhouse Gas Abatement Scheme in 2007 (more than 2.8 million NGACs).

Landfill gas renewable energy is second only to hydro in the delivery of carbon pollution reduction from renewable energy. In 2007, for example, landfill gas generation delivered nearly twice the level of carbon pollution reduction compared to wind energy.

Producing energy since the 1980s, landfill gas generation is the most significant 'waste to energy technology' in Australia. Approximately 80% of RECs produced by waste to energy come from landfill gas generation projects.

*Landfill gas power generation by state*

State	No. of Projects	Generation Capacity (megawatts)	Electricity Generated (gigawatt hours)
ACT	2	4.4	27.0
NSW	10	42.5	255.3
NT	1	1.1	9.3
QLD	9	16.6	96
SA	4	20.8	82.4
TAS	3	3.8	27.7
VIC	14	40.6	203.1
WA	10	22.5	147.9
<b>Total</b>	<b>53</b>	<b>152.3</b>	<b>848.6</b>

## Case Study: Tweed Shire Renewable Energy Facility

The power generation facility, owned by LMS Generation, is located at the Tweed Shire Council's Stotts Creek Landfill in the New South Wales hinterland.

The project comprises a 300kW internal combustion engine and provides more than 3,300MWh of electricity, making it the smallest single landfill gas power generation project in Australia.

The project is the first micro-power generation facility powered by landfill gas in Australia and is a showcase example of proven technology adapted for regional landfills whilst remaining efficient, profitable and saving over 15,000 tonnes of greenhouse gas emissions per year.

*Tweed Shire Renewable Energy Facility*



## With rising energy prices and increasing carbon pollution...

it is important to consider landfill gas as an environmentally-responsible, economically-competitive renewable fuel source that can be used to meet our future base-load energy needs whilst reducing carbon pollution.

## Renewable electricity from landfill energy

The recovery and use of methane from landfill provides a host of environmental and economic benefits to the Australian community:

- **World-leading technology** developed by Australian companies that provide real 'green-tech' jobs for Australians.
- **Achieves real environmental outcomes** at low cost to the community.
- **Significant financial and infrastructure investment** has already occurred with many millions of dollars of private expenditure planned for the future.
- **Building a dynamic local industry** that currently employs more than 300 people directly, and hundreds more indirectly, and is expanding internationally.
- **Providing reliable base-load generation** that can power up to 400,000 homes every day of the year without increasing greenhouse gas emissions. Landfill gas generation produces approximately 850GWh of electricity, currently equivalent to 10% of all Renewable Energy Certificates in 2008.
- **Reducing carbon pollution** and displacing fossil fuel. More than 4 million tonnes of greenhouse gas emissions are saved each year. This is equivalent to removing 1 million cars from the road or reducing the use of 11 million barrels of oil.
- **Reducing water use** by displacing fossil-fuelled generation resulting in savings of more than 1.6 billion litres of water during 2008.
- **Proven gas extraction rates of up to 90%** are being achieved in Australia from modern well engineered landfills.
- **Scientifically proven** to generate significantly more renewable energy than other waste treatment technologies available in Australia.

This brochure has been prepared by Green Energy Markets on behalf of Energy Developments Limited and LMS Generation Pty Ltd.



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harnessing  
bio-energy



base-load  
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power  
generation



massive greenhouse  
savings and reliable  
renewable energy supply