

Be Inspired – Let's Do Something to Reduce Global Warming at Our Landfills

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1. Introduction

The earth is coping with a crisis. The effect of technology within the industrialised world has resulted in greenhouse gas emission levels that are damaging the earth and threatening our way of life. Global warming will affect all of us if changes are not made to the amount of CO₂ being put into the atmosphere.

The amount of CO₂ in the atmosphere is currently at 380 parts per million being about 25% above the previously highest level of 300ppm. During the past 650,000 years, measured from ice core samples, the CO₂ concentration has ranged between 180 to 300ppm. This concentration is now increasing at the rate of 20ppm per decade. It is suggested that CO₂ concentrations will continue to climb until they reach critical levels of 550ppm unless major changes are made to the amount of emissions.

Temperature projections indicate an increase of 0.5°C and 1.5°C by 2030 and between 1°C and 5°C by 2070. An increase of 3°C would create irreparable damage.

Total Australian CO₂ emissions in 2004 were 565Mt of which waste contributed 3%. The majority of the CO₂ emissions are from stationary electricity generation. However, if the embedded energy of materials, such as steel, disposed to landfill were taken into account, the figure would be 6 to 8% for waste.

The pace of change on climate change awareness has been greater this year than in the previous twenty years. The corporate world and the community at large are now recognising this for the significant issue that it is.

In many cases, the environmental landfill operational licence would require the capture of landfill gas and its burning. The capture of methane created from the breakdown of the rubbish in landfills and its controlled burning will be up to 23 times less damaging than letting the gas escape into the atmosphere. This figure was recently upgraded from 21 times by the IPCC.

With the larger landfills, this process will result in the generation of green electricity. For the smaller sites, where electricity generation is not economically viable, the collection and flaring of the gas is a logical choice.

This paper will consider the effects of landfills on the atmosphere and discuss the methodologies for the collection and burning of the landfill gases generated to make a safer environment.

2. What can you do?

Local government, regional councils and landfill operators are able to contribute to reducing the effects of global warming by capturing methane gas generated by landfills and burning it, as every little bit will help. Think of the minimisation of CFCs and the effect it had on the hole in the ozone layer.

The type of gas system installed will depend on many factors, but primarily it will be based on the size of the landfill. The threshold will depend on the gas management contractor and thus there are no hard and fast rules to apply. In Landfill Gas and Power's (LGP's) case, we believe the landfill would need to service a population of 100,000 people before the generation of electricity would become economically viable. For smaller sites, it may be possible to generate electricity for internal use only or to flare the gas, thereby reducing its environmental effect.

2.1. Larger Landfills

The landfill gas capture system will be the same irrespective of the method of burning of the gas. This comprises the installation of a series of wells on a grid layout to collect the gas. The design of the grid is determined by the landfill characteristics, such as surface area, depth of waste, surface slopes and type of final cover provided. These wells are connected by pipes to the collecting manifold, which delivers the gas to power the station via a vacuum pump. The wellfield operates under a slightly negative pressure to draw the gas out.



Gas delivered to the power station has to be prepared for consumption in engines modified for landfill gas combustion. The pre-treatment process will vary depending on the composition of the landfill gas and the contractor as each has developed their own expertise from operating these plants over many years. This is where a competitive advantage can be gained and thus the intellectual property involved is closely guarded.

Once the gas has been cleaned ready for combustion, it is delivered to the engines. The number of engines and generating units will depend on the volume of gas being delivered from the landfill wellfield. New engines typically have the capacity to generate from 1MW to 2MW of electricity. In LGP's case, we have a mix of engines generating from 650kW to 1MW of electricity at our four power stations thereby providing added flexibility and the opportunity to maximise electricity generation from the available gas supply.

The gas supply is generally constant, but can vary depending on a number of factors, including seasonal changes. Thus it is important to continually monitor the wellfield to ensure optimum gas that is being produced is captured and is available for combustion, thereby maximising electricity generation.

Electricity generated is pumped into the electricity grid and in LGP's case, sold to our contracted customers. The electricity grid provider charges an access service fee for using their infrastructure in getting the electricity to the customers and generally provides the meter reading service at the customer's end.

Generally this type of installation will have a flare, which is available for use in the event of the power station being out of action. This ensures compliance with the environmental requirements to dispose of the gas generated from the landfill in an acceptable environmentally friendly manner.

In time, the amount of gas generated will be insufficient for viable electricity operations. At this time, the power station would be removed and any remaining gas generated would be flared using the existing facility, or in some cases, where gas has declined considerably, a smaller flare may be required.

Power station operations can be monitored from a remote central location and thus the stations can be down the street, in another state or even another country. On site personnel are required to attend to wellfield monitoring and undertake routine maintenance works.

2.2. Smaller Landfills

As previously mentioned, the wellfield gas collection system will be the same as the system for large landfills. Monitoring of the smaller wellfield is not as intense as for electricity production as the main purpose is to ensure the proper destruction of any gas generated via a flare system. However, periodic checks are required to ensure there are no leaks in the wellfield pipework, the maximum amount of gas is collected and it is functioning as designed.

The flare construction is of a similar standard as the standby flare at the power station discussed above. The flare would operate continuously and its size will be based on the peak gas production. With time and as gas production declines, the flare would be operated at lower volumes or downsized to a smaller flare.

Again, remote monitoring of the operation of the flare is possible. Thus, personnel would only be required on site for any repair or diagnostic work.

Another option at smaller landfills, is the generation of electricity for internal consumption on the site. This could be in the range of 30 to 500kW. Thus the combustion of the gas can be used to offset electricity charges for the operation of the site.

3. Government Action to Date on Renewable Energy

The action taken by the various levels of government within Australia has been quite varied. The following provides a brief outline of the status of the State and Federal Governments as at August 2007.

Recent media attention and publicity relating to the Al Gore movie "An Inconvenient Truth" and the release of the Stern Report has brought the issue onto the main political agenda.

3.1. Federal Government

Carbon trading markets are set up primarily to address the increasing concentration of greenhouse gases, generated by human activity, which contributes to the heating of the atmosphere with the long term effect being global warming.

The Australian Federal Government has set its targets under the Mandatory Renewable Energy Target (MRET) through until 2020 and is now looking for further gains from technological advances. The target set is to increase



generation capacity from 300GWh in 2001 to 9,500GWh by 2010 and to maintain this level until 2020. Renewable energy generators are able to create Renewable Energy Certificates (RECs) for sale to black power generators to meet their obligations under the scheme. The scheme was introduced to assist with the construction of additional renewable energy electricity projects.

As at December 2005, a total of 15,979,308 Renewable Energy Certificates (RECs) had been created from 229 accredited power stations. Landfill gas contributed 1,318,169 RECs or 8% to this total. (The 2006 report is due out in the near future).

The two gases associated with Landfill Gas and Power's activities, contributing to the build up of greenhouse gases are Carbon Dioxide (CO₂) and Methane (CH₄). CH₄ has 23 times greater potential for global warming than CO₂. However, the relative contribution of each gas is 82.7% for CO₂ and 10% for CH₄. CH₄ from waste contributes 0.9Mt of the total of 5.7Mt for all CH₄ contributing to the greenhouse gases.

Many of the major Australian landfills now have methane capture systems for its collection and burning to generate renewable electricity.

About 50% of Australia's greenhouse emissions are emitted from stationary energy, and electricity generation contributes 75% of this figure. Australia, because of its reliance on coal for electricity generation, has the highest per capita emissions of CO₂ of any country in the industrialised world.

In 2004, the Australian Federal Government created the \$500 million Low Emissions Technology Development Fund. Two significant projects funded under this Fund were:

1. \$75 million for a \$420 million project to build a large scale solar concentrator in regional Victoria to be built by Solar Systems. The project will commence in 2008 and reach full capacity by 2013; and
2. \$50 million towards a \$360 million pilot for a brown coal drying and post combustion CO₂ capture and storage project at International Power's Hazelwood facility. Construction will begin early next year with the project to be completed by the end of 2009.

More recently, the Federal Government has announced that Australia is heading towards a national market based carbon trading scheme to be operational by 2011 with the announcement by the Prime Minister, Mr John Howard in early June 2007. It is envisaged the scheme would cover 75% of the major emitters in Australian industry and will spawn a new world of financial products and derivatives markets to trade carbon credits and offset risk.

The proposed Emissions Trading Scheme (ETS) will cover stationary generators and the transport sectors making it a more comprehensive scheme than the European model (EU ETS). However, agriculture and waste (3% of emissions) are being left out of the initial scheme. At present, generators omit 200Mt of CO₂-e per annum.

The preferable ETS is a "cap and trade" format with a cap that will be adjusted periodically as science advises accordingly. It will be a licence to emit, rather than creating property rights like the EU ETS did in its first phase leading to oversupply of credits and unnecessary and unrealistic windfall profits for some companies. By setting caps, it limits total emissions and therefore there will be environmental gains.

The ETS proposes the dismantling of the existing State schemes and the phasing out of the MRET scheme for the renewable energy industry. However, industry does not see the abandonment of MRETs as a possibility as support for existing arrangements would need to be continued to prevent assets becoming stranded.

3.2. State Governments

Most state governments, following a similar trend in the USA with limited action by the Federal Government, are introducing their own schemes to encourage the creation of new sources of renewable energy.

1. **Queensland:** Their scheme, introduced on 1 January 2005 and to operate for 15 years, requires electricity retailers to source at least 13% of their electricity from gas-fired generation. The eligible fuels are natural gas, coal seam gas, liquidified petroleum gas as well as waste gases from conventional petroleum refining. Queensland has extensive reserves of coal seam gas and electricity generation from this fuel source is expanding rapidly.
2. **New South Wales and ACT:** The scheme has been operating in NSW for three years and was expanded to the ACT commencing 1 January 2005 involving the creation of NSW Greenhouse Abatement Certificates (NGACs). The aim is to reduce greenhouse gas emission for electricity purchased by consumers on a per capita emission target. The target is presently set at 7.27 tonnes per person, being 5% below the equivalent NSW per capita emissions prevailing in 1990, the baseline measurement year used under the Kyoto Protocol. The scheme was originally intended to operate until 2012, but the Government has extended its operation until 2020 or until such



time as a national emission trading scheme is introduced.

3. **Victoria:** The Victorian Renewable Energy Target (VRET), which commenced on 1 January 2007, is modelled closely on the Federal MRET scheme. It places the legal obligation on the electricity retailers to acquire 10% of electricity from renewable energy. It is expected this initiative will create \$2 billion in expenditure and increase the average household electricity bill by \$10 per annum.
4. **South Australia:** Their scheme presently requires 15% of electricity from renewable energy. This target is expected to be increased to 20% although the state does not have a high electricity demand.
5. **Western Australia:** The WA Government has a target of 6% of electricity production from renewable energy, although no scheme supporting the proposal. Production is already nearing this target. The Greens presently have a Bill before the Parliament to increase the target to 20%. Synergy is offering residents the opportunity to buy their renewable energy electricity at a premium. It is estimated to cost an average household an additional 47 cents per day or more than \$170 per annum. The State Government has indicated that future supplies of its electricity must include 20% of renewable energy.

4. Way Forward

Our present system of power generation provides cheap electricity to industry to remain competitive in the international marketplace. Neither political party will destroy Australia's competitive advantage in energy. However, the Federal Opposition wants to ratify the existing Kyoto agreement, to sign up to a global emission trading system and to give a stronger focus on renewable energy.

The Stern Report takes the global warming debate to its economics, its price effects and what decarbonisation means. It calls for the introduction of a global emissions trading scheme within the next 10 to 15 years. Some commentators are discrediting the report as its analysis is based on worst case scenarios.

At the same time, the Federal Government is looking at building nuclear power stations, which are predicted to become commercially viable within the next 15 years, as a partial solution to the level of CO₂ emissions and is planning to introduce a carbon emissions trading scheme by 2012.

5. Our Company

Landfill Gas and Power Pty Ltd is a West Australian-owned company, which has taken the extraction and application of landfill gas as a safe, clean and reliable energy source from concept to reality in Western Australia. With a growing list of successful projects and recognition for its work both in Australia and overseas, LGP is emerging as a market leader in the development of waste to energy technologies.

LGP currently owns and operates four waste-to-energy Power Stations located at Red Hill, Canning Vale, Kalamunda and Tamala Park and manages the gas emissions from six metropolitan landfill sites located nearby to these stations. The company derives income from the sale of electricity to private industry consumers, pursuant to long-term contracts.

LGP is a private company owned by WesTrac Holdings Pty Ltd (WesTrac), WA's Caterpillar equipment dealer. LGP, like WesTrac, is part of billionaire Mr Kerry Stokes' Australian Capital Equity group of companies and has strong support strategically, administratively and operationally from Australian Capital Equity and its subsidiaries.

The successful growth of the company over the past fourteen years, together with the quality of its income stream and the acceptance of its technology, demonstrate the quality of LGP's management. The group has also installed reliable financial reporting systems, to ensure management can maintain its control over the financial aspects of the business.

LGP commissioned its first Renewable Energy power station at Red Hill in 1993 and its second power station including engine heat recovery at Brockway (Challenge Stadium) in 1994, which was subsequently decommissioned in 2004 following the depletion of the gas source. In 1995, LGP commissioned its third power station at Canning Vale and commissioned its fourth power station at Kalamunda in 1996. The most recent, being LGP's fifth and largest power station at Tamala Park, was commissioned in January 2004 and expanded in 2005. A major refurbishment of the original Red Hill power station, incorporating all of the improvements made in the other power stations, was completed in June 2007.

The Management Team of LGP has been chosen specifically for their proven performance levels within their chosen fields.

More information is available from the LGP web site at www.landfillgas.com.au



6. Conclusion

Our planet is changing as a result of human activity. The level of awareness around this issue is changing rapidly and it has now become a major political issue. Action is required now to reverse the trends and to ensure the long term viability of the planet and the lifestyles that we enjoy.

Local government, regional councils and landfill operators have an obligation to operate their landfills in an environmentally sustainable manner. One key aspect of this is the collection and proper disposal of the landfill gas generated.

The generation of electricity, in addition to minimising the environmental effects of the gas generated by the landfill is producing renewable green electricity and is therefore offsetting the need for additional black electricity generated from fossil fuel products. It therefore has a compounding benefit for the environment.

If your landfill does not presently have a gas extraction system and method of burning the collected gas, the time is now here to consider the option.

