carbon partners

Carbon Partners PTY LTD ABN 17 098 302 289
Level 2, 40 Albert Road, South Melbourne 3205 Australia
Telephone: +61 3 8807 4666 Facsimile: +61 3 8807 4667 www.carbonpartners.net

Submission No: 124

29 June 2007

The Committee Secretary
House of Representatives Standing Committee on Industry and Resources
Parliament House
Canberra ACT 2600

Dear Sir

Case Study into Selected Renewable Energy Sectors

Key Points

- Bioenergy can deliver baseload renewable power;
- Mature technology;
- Market drivers rapidly evolving;
- Reliable and significant existing sources of organic waste inputs; and
- Major immediate implementation and long-term growth potential.

Background

Carbon Partners is pleased to make the attached submission to the House of Representatives Standing Committee on Industry and Resources Case Study Inquiry into the development in Australia of the solar, wave tidal, geothermal, wind, hydrogen and bioenergy renewable energy sectors and their prospects for economically viable electricity generation, storage and transmission.

This submission is based generally on Carbon Partners' experience in the bioenergy sector with particular emphasis on anaerobic digestion (or biogas) technology for the generation of embedded base-load renewable power.

About Carbon Partners

Carbon Partners was established in 2001 to develop renewable power generation projects that utilise a highly efficient anaerobic digestion process to convert organic wastes into biogas and a premium quality organic fertiliser by-product.

Carbon Partners is part of the broader Szencorp Group of Companies (www.szencorp.net) a leading developer and provider of innovative sustainability solutions in the built environment. The Group has been operating for over 20 years and employs about 65 people in Australia and 20 overseas.

The Szencorp Group's activities focus on sustainability and innovation. Its ability to deliver these outcomes are tangibly demonstrated through the Szencorp head office at 40 Albert Road in South Melbourne. The Szencorp Building is Australia's highest rated sustainable building (www.ourgreenoffice.com) and its features have been well documented in local and international media coverage. The Szencorp Building has incorporated a number of Australian technological "firsts" and has subsequently won many major industry and sustainability awards.

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Carbon Partners is currently in the process of developing of an organic waste-to-energy facility in Dandenong South in Melbourne. This facility will accept up to 140,000 tonnes of mixed food and green organics and will have 6.8 MW of installed generation capacity fuelled by methane (or biogas) produced by the anaerobic digestion process. This facility has received both Planning and EPA Works Approval. Carbon Partners is also exploring similar project opportunities, particularly in regional Victoria.

Summary

Increasing the use of biogas technology in Australia creates a wide range of positive environmental, social and economic benefits. Bioenergy has major growth potential in Australia - with a broad range of reliable existing feedstock sources and key commercial and other drivers evolving rapidly.

Further, bioenergy, whilst being a major existing renewable energy generation source in Australia, is relatively unknown in the public and policy sense. As an industry, it has not promoted itself well.

A short list of examples of existing Australian bioenergy project applications include:

- landfill gas extraction and power generation;
- waste water treatment facility methane capture and power generation;
- intensive agricultural anaerobic digestion-based manure management and power generation;
- anaerobic digestion-based commercial organic waste management and power generation; and
- power generation from sugar cane, nut and timber production residues.

Commonly, bioenergy projects are capable of generating baseload renewable power, despite there being an uninformed public (and government) perception that renewable power technologies cannot do this. The advanced biogas projects being developed by Carbon Partners not only generate baseload power, but they also recycle organic wastes that are often otherwise sent to landfill, burnt or spread on open fields.

As a result, environmental outcomes from these facilities will accrue not just for waste and clean energy, but water savings, biosecurity, water catchment health and local amenity. Further, the likely location for many of these plants will be in areas close to organic waste sources and potential power and/or heat demand - such as areas of strong agricultural and regional economic activity.

Larger-scale biogas projects are fully engineered and controlled industrial processes that will be generally located either in industrial or waste processing areas, or as part of waste water treatment plants. They are therefore not likely to be subject to visual or other amenity concerns that may affect wind farm development.

The biogas technology is well established in Europe, with some plants having now been in operation for **well over 20-years**. By the end of 2006, there were an estimated **3,500** separate anaerobic digestion facilities installed across Germany, with a cumulative installed baseload electrical generation capacity of **1,100 MW** (of which over 800 MW has been installed since December 2004 alone). Combined, these facilities generate an estimated **5 billion kWh of electricity each year** and achieve net greenhouse gas abatement of over **5 million tonnes of CO2e per annum**. The feedstocks for these facilities range from agricultural and municipal wastes, through to purpose grown energy crops such as maize. There are an estimated 400 small-to-medium enterprises now operating in the German

biogas industry, directly employing over **10,000 people**. By the end of 2006, net investment in the sector is estimated to exceed **1 billion Euros**.

Whilst purpose grown energy crops can be utilised for stationary bioenergy renewable power systems, in Australia there already exists significant and reliable quantities of organic waste streams that are suitable inputs for bioenergy projects. These wastes are currently often subject to environmentally inappropriate disposal practices. The Australian resource potential for bioenergy is therefore significant as are the range and depth of benefits associated with sound and well established bioenergy technologies. The extent of this potential is outlined in the pages that follow.

In Carbon Partners' view, bioenergy has **strong potential** to deliver a significant portion of Australia's current and future clean energy needs. The technology is **well established** and the market drivers required to drive this growth are evolving rapidly and this form of clean power generation has the potential to deliver a range of carbon abatement and other national benefits.

Carbon Partners believes that it is the adaptation or demonstration of many of these well established overseas technologies to Australian conditions that should be the focus of short-term government policies in order to deliver sound and early implementation of clean energy options.

Yours sincerely

David Paice
Managing Director

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1. Summary

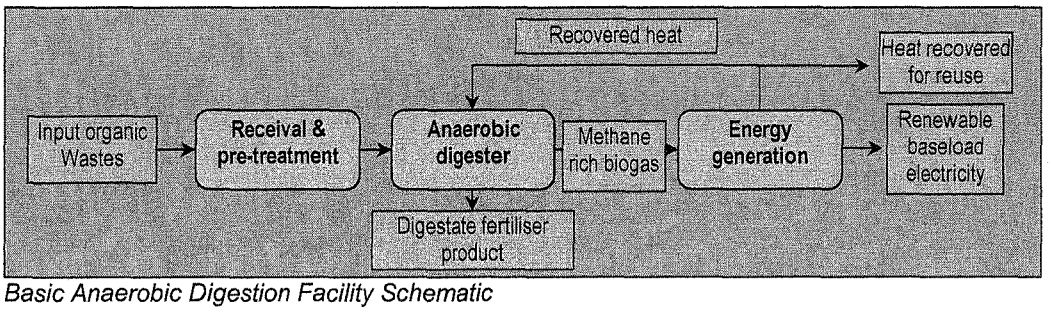
Australia's future energy needs will not be met by a single "silver-bullet" technology but rather from a range of technologies including: renewable energy generation, "cleaner" energy generation and sequestration technologies.

Within the renewable energy sector itself, there are a range of technologies and outcomes currently available. Australia has generally lagged other parts of the world in developing and implementing renewable energy technologies.

Carbon Partners believes that it is the adaptation or demonstration of many of these well established overseas technologies to Australian conditions that should be the focus of short-term government policies in order to deliver sound and early implementation of clean energy options.

2. What is Biogas Technology?

Anaerobic digestion (biogas) technology harnesses naturally occurring anaerobic digestion processes, in which complex organic matter is converted into simpler, more stable organic compounds in the absence of oxygen. A basic schematic outlining the key steps in an anaerobic digestion process are outlined below.



Basic Anaerobic Digestion Facility Schematic

The methane-rich biogas stream generated by this process is typically used for renewable electricity generation or, alternatively, it can be purified and compressed for use as a transport fuel, with similar combustion characteristics to compressed natural gas. The nutrient-rich organic fertiliser product also generated by the process is a generally a high quality soil conditioner and chemical fertiliser substitute suitable for home gardening, agricultural and horticultural applications.

Engineered anaerobic digestion facilities have been applied extensively for over the past century, principally for the treatment of concentrated waste water and biosolids streams. Over the past two decades, however, there has been a considerable resurgence in interest in the technology as a platform for renewable energy generation. Distributed anaerobic digestion facilities are being deployed on a significant scale across Germany and other European countries, where it is considered to be a mature and highly-scalable technology.

3. Biogas is Baseload Energy

Biogas renewable energy is capable of providing baseload power - that is, renewable power generated 24 hours a day for 7 days a week – and can be "embedded" in the power network which reduces transmission losses.

Furthermore, the reciprocating gas engine technology commonly used in these facilities is proven; capable of operating continuously for over 90% of a given year (with programmed downtime for engine maintenance); and has an established maintenance and engineering service expertise base in Australia. Most biogas engines are capable of running on both methane and natural gas. These features overcome virtually all of the key criticisms levelled at renewable energy.

4. Comparisons between Generation Technologies

The following graph shows a comparison of the general cost of various generation technologies. The Carbon Partners cost of generation will depend upon a range of project factors – including project size and range of non-power income streams.

Comparisons between energy generation technologies both conventional and renewable after often compared on a ***$/unit of electricity generated*** basis. The focus on this metric as the sole means for comparing electricity generation technologies is problematic as it fails to recognise:

- that transmission and distribution costs can account for up to 40% to 50% of the total ***delivered*** energy cost to consumers - a cost which embedded renewable energy generation technologies (such as biogas) can avoid;
- the potential to recover and productively reuse heat energy from embedded energy generation technologies such as biogas and biomass technologies; and
- the other economic, environmental or social benefits unique to a particular technology such as those identified for biogas technologies above.

5. Eligible Input Waste Streams

Anaerobic digestion projects can digest a wide range of organic waste from municipal (kerbside collected green and food waste); manufacturing (food and abattoir wastes) and agricultural (animal manures, mortalities, and crop residues) sectors.

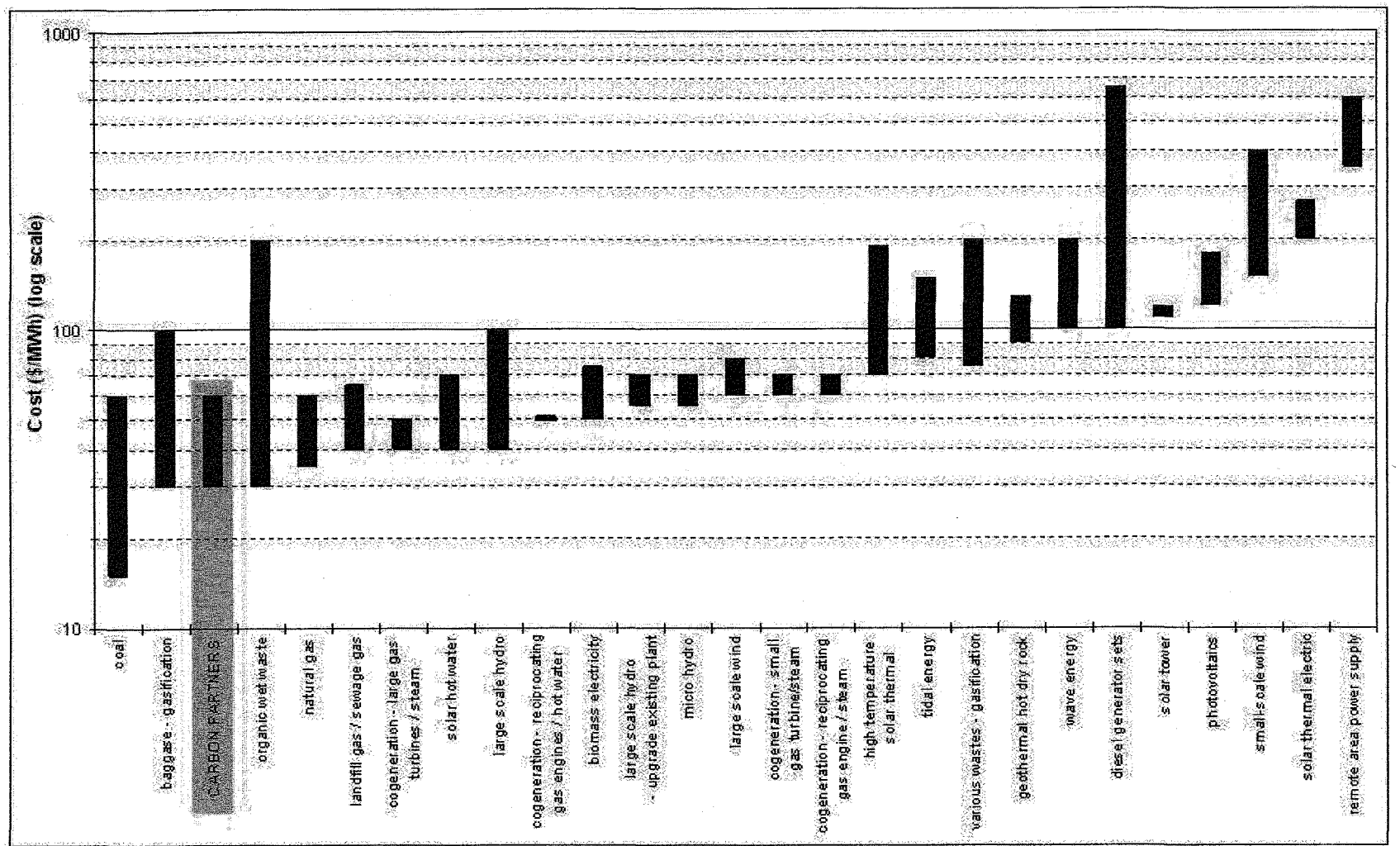
Municipal Organic Waste

In the 2002-03 financial year, at least **5 million tonnes of food and garden organic wastes** were collected from household, commercial and industrial sources across Australia. Approximately two-thirds of this waste is disposed to landfill with the balance being recycled, typically via a composting process, into soil, mulch and compost products.

The placement and degradation of organic wastes in landfills leads to the generation of methane gas, a significant proportion of which can be captured and used for electricity generation. Indeed, there are currently **50 landfill sites** across Australia which have gas capture systems installed with a combined electrical generation capacity of **130 MW.**

A number of factors are converging to support the development of purpose-built, engineered, fully enclosed and fully-controlled anaerobic digestion facilities - such as those proposed by Carbon Partners - and which generate renewable electricity from source separated municipal green and organic wastes. These factors include:

- increasing overall waste generation rates;
- limited existing landfill space, combined with the high cost, long-lead times, regulatory constraints and community concerns regarding the development of new landfill sites in suitable locations;
- legislated State Government targets for waste diversion from landfills;
- increasing penetration of compulsory source-separated kerbside garden waste collection services with the expected inclusion of food waste in the near future;
- increasing landfill gate fees and State Government landfill levies (the prime intent of which is to encourage resource efficiency and alternative waste management solutions); and
- limited capability of existing composting operations to process the growing input organic waste streams being generated, combined with relatively small markets for the ever increasing stockpiles of the output compost product generated.



Ref: Renewable Energy Technology Roadmap, Commonwealth Department of Industries Science and Resources 2002 (Carbon Partners generation cost range inserted)

Australia's first municipal waste-to-energy facility is located at Camellia in Western Sydney. This facility was developed by Earthpower Technologies at a total cost of $36 million, and commenced operations in 2003. It has capacity to process up to 80,000 tonnes pa of source segregated food waste and has 3.5 MW installed generation capacity.

A subsequent municipal waste-to-energy facility was commissioned at Eastern Creek, also in Sydney, by Global Renewables Limited.

Carbon Partners is currently in the process of developing of an organic waste-to-energy facility in Dandenong South in Melbourne. This facility will accept up to 140,000 tonnes of mixed food and green organics and will have 6.8 MW of installed generation capacity. This facility has received both Planning and EPA Works Approval. Carbon Partners is also exploring similar project opportunities, particularly in regional Victoria. The potential for these types of projects through metropolitan and regional Australia is significant.

Agricultural Residues and Wastes

Australia's agricultural sector generates a wide range of organic residues, including manures, spent bedding, animal mortalities, and other wastes such as grape mark, all of which are potential feedstocks for renewable energy generation facilities using anaerobic digestion technology.

Significant consolidation is occurring in the agribusiness sector, particularly regarding the development of large intensive animal farming operations, such as covered dairy and beef feedlots. These facilities are major "point-source" generators of manure streams, and require appropriate treatment infrastructure to be installed in order to ensure compliance with local environmental and planning regulations and present an immediate opportunity for renewable energy generation form anaerobic digestion.

The rapid deployment of biofuel facilities in Australia, such as bioethanol and biodiesel, and their respective distiller's grains and glycerol "waste" streams present a further opportunity for anaerobic digestion, which can convert these streams to renewable and cost-effective power and heat streams to supply the biofuel facility.

In the medium term, increased environmental regulation and enforcement, as well as tighter animal disease and pathogen controls, is also expected to play a greater role in supporting the development of fully-contained on-farm waste management systems. In the longer term development of facilities operating wholly or in-part on energy crops such as maize, presents considerable further renewable energy generation opportunities.

6. Significant and/or Unique Benefits of Biogas Power Generation Projects

Anaerobic digestion technology can make a significant contribution to Australia's overall sustainable energy generation mix and also provides a unique range of additional environmental, economic and other benefits, including the provision of:

1. ***reliable baseload renewable energy generation*** (both electricity and heat) using a proven existing technology which can be deployed in a relatively short-time frame and in increments matching near-term demand;
2. ***improved power reliability and security:*** embedded baseload generation, such as that provided by biogas facilities, can improve network power quality and reliability and avoid the need for standby generation equipment;
3. ***"multiplier-effect" greenhouse gas abatement:*** biogas facilities avoid the methane generated from business-as-usual waste disposal practices as well as from the avoided electricity generation emissions. This abatement is considered to be of high quality given it is significant, reliable and readily auditable;

4. ***fully contained and sustainable waste management***: biogas facilities treat organic waste streams in fully contained and enclosed process, avoiding any groundwater, odour and other local amenity impacts from the business-as-usual waste disposal practices;
5. ***water reclamation:*** potential to treat and reclaim water for reuse avoiding the use of freshwater supplies;
6. ***network infrastructure cost savings:*** biogas facilities can be embedded within or very close to centres of energy demand (towns or manufacturing sites) potentially avoiding or deferring the need for new network infrastructure and the associated cost;
7. ***heat recovery:*** the otherwise "waste" heat generated by biogas facilities can be recovered and productively reused;
8. ***regional development outcomes:*** the highly disbursed regional nature of such facilities contributes to regional economic activity and employment;
9. ***stabilised nutrient-rich organic fertiliser product:*** which is suitable for use as a soil ameliorant or chemical fertiliser substitute;
10. ***a wide range of applications and scalability:*** biogas technology has been proven on a wide range of organic waste streams and across a range of generation capacities 0.1 to 10 MW+); and
11. ***proven technology:*** biogas facilities integrate a range of established technologies which have known operating and maintenance characteristics and long-standing records of performance (tanks, pumps, reciprocating gas engines, etc);
12. ***capacity to leverage existing Australian technical capability:*** Australia has established world-class capability regarding the engineering design, construction and operation of water, waste and environmental infrastructure assets, all of which can readily apply to the construction and operation of biogas facilities;

7. German Biogas Experience

The German Biogas experience demonstrates the considerable potential of biogas technology. The German Renewable Energy Act, enacted in 2000, and expanded in 2004, legislated a range of measures to support the development of a wide range of renewable energy technologies, including preferential grid access and long-term feed-in tariffs for renewable energy generators.

Since implementation, this act has stimulated significant investment in anaerobic digestion facilities and ***demonstrates the capability of anaerobic digestion technology to be deployed on a rapid and significant scale.***

By the end of 2006, there were an estimated ***3,500 separate anaerobic digestion facilities installed*** across Germany, with a cumulative installed baseload electrical generation capacity of ***1,100 MW*** (of which over ***800 MW*** has been installed since December 2004 alone).

Combined, these facilities generate an estimated 5 billion kWh of electricity each year and achieve net greenhouse gas abatement of over 5 million tonnes CO2e pa. The feedstock's for these facilities range from agricultural and municipal wastes, through to purpose grown energy crops such as maize.

There are an estimated 400 small-to-medium enterprises now operating in the German biogas industry, directly employing over 10,000 people. By the end of 2006, net investment in the sector is estimated to exceed 1 billion Euros[1].

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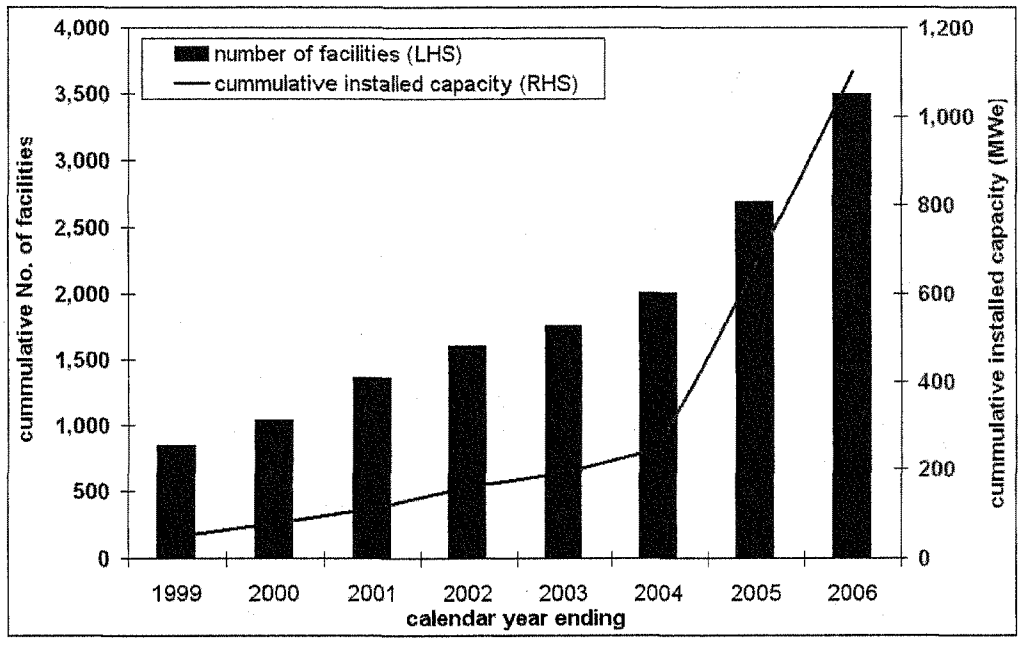
[1] REF: German Biogas Industry Association Media Release, 15 November 2006 (translated from German)
http://www.biogas.org/datenbank/file/notmember/presse/PM_061115-EuroTier06_Jahresprog.pdf
German Government Website: www.renewables-made-in-germany.com/en/biogas

Centralised anaerobic digestion facilities, which receive and process municipal organic waste, are becoming commonplace across Europe, ***with an estimated 120 full-scale facilities processing over 4 million tonnes of municipal organic waste each year***[2].



Full-Scale Anaerobic Digestion Facility Roll-Out in Germany

8. Prospects for economically viable electricity generation

In Carbon Partners view, bioenergy has strong potential to deliver a significant portion of Australia's current and future energy needs at negligible risk. The technology is well established, the market drivers required to drive this growth are evolving rapidly, and this form of clean power generation has the sound potential to deliver a range of significant carbon abatement and other national benefits.

Carbon Partners believes that it is the adaptation or demonstration of many of these well established overseas technologies to Australian conditions that should be the focus of short-term government policies in order to deliver sound and early implementation of clean energy options.

Some of the existing structural and market barrier impediments to small-scale embedded generation will also need to be addressed in order to shift the growth curve for renewable energy.

[2] REF: De Baere, L., "Will Anaerobic Digestion of solid waste survive the future", Water Science and Technology, Vol 53 No 8, pp 187-194 2006. www.iwaponline.com/wst/05308/wst053080187.htm