



Submission No. 43

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The Secretary  
House of Representatives Agriculture, Resources, Fisheries and Forestry Committee  
PO Box 6021  
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Dear Dr Pender

### **Submission for Inquiry into Growing Australian Forestry**

The purpose of this submission from Bioenergy Australia is to alert the Committee to the status and significant role bioenergy could make towards the provision of base-load power and towards transportation fuels in Australia from the forestry industry, while assisting with domestic energy security, job creation essentially in rural areas, and providing various environmental benefits, most notably mitigating carbon dioxide emissions.

Bioenergy Australia is a nation-wide government-industry alliance of some 83 organisations, established to foster biomass as a source of sustainable energy and for value-added bio-products such as biofuels. Its broad objectives are to:

- Promote an awareness and understanding of the economic, social and environmental attributes of sustainable energy from biomass.
- Broaden the market for biomass by enhancing opportunities, and by helping to reduce financial, regulatory, fuel supply, technical and institutional barriers to enable widespread adoption of biomass energy.
- Facilitate the development and deployment of biomass energy business opportunities and projects.

Bioenergy Australia is also the vehicle for Australia's participation in the International Energy Agency's Bioenergy program, an international collaborative RD&D (research, development and demonstration) agreement involving some 23 countries plus the European Commission. The Bioenergy Australia Manager represents Australia on the Executive Committee of IEA Bioenergy, which covers the broad spectrum of bioenergy, including bioelectricity and biofuels. Bioenergy Australia acts as a forum for general and authoritative information dissemination on bioenergy, including drawing on international best practice experiences through its IEA Bioenergy participation.

Please note that this submission does not necessarily reflect the view of individual member organisations. It is also expected that some Bioenergy Australia members, such as Winwick Business Solutions will separately provide their individual submissions to the Inquiry.

Biomass refers to organic matter, derived in recent times, directly or indirectly, from plants, as a result of the photosynthesis. It includes a wide variety of materials, including forestry residues, waste by-products from wood processing, purpose grown woody energy crops, to woody weeds and urban tree loppings. Bioenergy is the term used to describe energy and energy related products derived from biomass.

Bioenergy can be regarded as a form of solar energy, as photosynthesis combines atmospheric carbon dioxide with water in the presence of sunlight to form the biomass, while also producing oxygen.

The energy bound into the biomass can be recovered through the variety of bioenergy processes and technologies. During the energy recovery process, the carbon dioxide bound in the biomass is released to the atmosphere. Bioenergy is regarded as renewable, when the biomass resource consumed in the energy conversion process is replenished by the growth of an equivalent amount of biomass. Under the Kyoto Protocol bioenergy is regarded as carbon dioxide neutral.

Globally some 220 billion dry tonnes of biomass are produced through photosynthesis per year. The energy stored globally in biomass represents about 0.02% of solar energy incident on earth. This small portion of the absorbed energy is equivalent to approximately eight times the global anthropogenic primary energy consumption of around 400EJ/year.

According to the International Energy Agency’s data [1], renewable energy sources provide some 12.7% of the world’s total primary energy supply. Of this, some 9.9 percentage points are from renewable combustibles and waste (i.e. biomass). In the OECD countries, renewable combustibles and waste provide 55.7% of the total renewable energy supply. Figure 1 below illustrates the makeup of the nearly ten percent of global primary energy provided by biomass [2]. While two-thirds is non-commercial fuel wood, mainly in developing countries, most of the balance of the biomass used is from the forestry or wood processing sectors in developed countries.

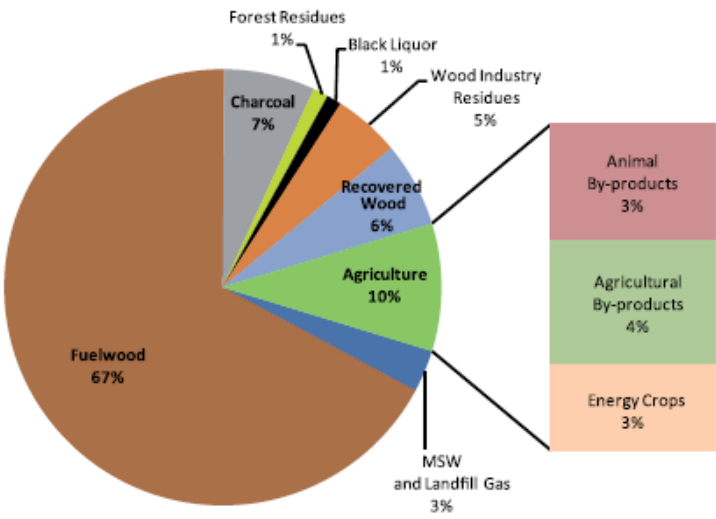


Figure 1: Share of the biomass sources in the primary bioenergy mix. Source: based on data from IPCC, 2007.

Figure 2 shows a table of Australian biomass resources, projected to both 2020 and 2050 from the Clean Energy Council's Bioenergy Roadmap [3], highlighting forestry bioenergy potential (in bold text).

<b>Biomass Source</b>	<b>Quantity</b>	<b>2010 (GWh/y)</b>	<b>2020 (GWh/y)</b>	<b>2050 (GWh/y)</b>
Poultry	94 million	-	297	1055
Cattle – feedlots	870 thousand	-	112	442
Pigs	1.8 million	1	22	205
Dairy cows	1.4 million	-	22	89
Abattoirs	1.3 million tonnes		337	1773
Stubble – grain and cotton crops	24 million tonnes			47000
Bagasse	5 million tonnes	1200	3000	4600
Sugar cane trash, tops and leaves	4 million tonnes	-	165	3200
<b>Oil mallee Eucalypts</b>	-	-	<b>112</b>	<b>484</b>
Camphor laurel			83	20
<b>Forest residues (native forests, plantations, processing residues)</b>	<b>~ 9 million tonnes</b>	<b>79</b>	<b>2442</b>	<b>4554</b>
<b>Black liquor</b>	-	<b>285</b>	<b>365</b>	<b>365</b>
<b>Other pulp and paper wastes</b>	-	<b>74</b>	<b>141</b>	<b>141</b>
Urban food Wastes	2.9 million tonnes	29	267	754
Garden organics	2.3 million tonnes	29	121	461
<b>Urban paper and cardboard</b>	<b>2.3 million tonnes</b>	-	<b>38</b>	<b>1749</b>
<b>Urban wood/timber wastes</b>	<b>1.6 million tonnes</b>	<b>45</b>	<b>295</b>	<b>1366</b>
Landfill gas		772	1880	3420
Sewage gas		57	901	929

Source: Clean Energy Council, 2008

Figure 2: Biomass Resources and Bioenergy Generation Potential - Source: Clean Energy Council, 2008

Figure 2 took a conservative approach to estimating future biomass resources. None-the-less Figure 2 illustrates that there is considerable potential for generating stationary energy (heat and power) from forest based industry wastes and oil mallee energy crops.

Subsequent research by the Future Farm Industries CRC [4] has indentified a large potential for coppiced mallee as a feedstock for bioenergy (heat, power, fuels). The FFI CRC studies predict biomass production from woody crops utilising surplus and degraded agricultural land could also provide environmental benefit. At a biomass price of \$35/t (green) and a water use efficiency of 1.8 dry g/kg of water, they model that profitable woody crops could produce 39 million tonnes/annum of dry biomass from 1.5% of farmland in the 300-400mm rainfall zone, and 8% of farmland in the 401–600 mm rainfall zone of the southern Australian wheatbelt.

Figure 3 shows Australian bioelectricity generation in 2009 [5]. Wood waste amounts to 73MW. This is overshadowed by bagasse and biogas energy production.

	<b>Biogas</b>	<b>Bagasse</b>	<b>Wood Waste</b>	<b>Other bioenergy</b>	<b>Total bioenergy</b>
New South Wales (incl ACT)	73	81	42	3	199
Victoria	80	0	0	34	114
Queensland	19	377	15	4	415
South Australia	22	0	10	0	32
Western Australia	27	6	6	63	102
Tasmania	4	0	0	0	4
Northern Territory	1	0	0	0	1
<b>Australia</b>	<b>226</b>	<b>464</b>	<b>73</b>	<b>104</b>	<b>867</b>
Share of total renewable electricity capacity (%)	<b>2.2</b>	<b>4.4</b>	<b>0.7</b>	<b>1.0</b>	<b>8.3</b>

Figure 3: Australian Bioelectricity Generation (MW) 2009 (source: Geoscience Australia)

It is generally recognised that the use of biomass for industrial heat provides substantial greenhouse gas mitigation, and this type of opportunity should not be overlooked in the Committee’s deliberations. While cogeneration (combined heat and power) is generally preferable to stand alone bioelectricity power plants, such electricity only plants should not be dismissed, especially considering that industrial process heat or residential heating applications may not exist at a particular site. It should also be noted that the Government’s Renewable Energy Target only provides incentives for the electricity, not the heat component of cogeneration.

Biosequestration is exemplified by growing trees as a permanent store of carbon. This is illustrated in Figure 4 below. In this illustration, extracted from the Bioenergy Australia -

Rural Industries Research and Development Corporation’s ‘Carbon Trading and Renewable Energy’ report 08/184 (copy of full report attached which forms part of this submission), a stand of trees would grow to maturity over a period of approximately 50 years, with the carbon stock plateauing at around 50 years. The carbon would be stored in both the above ground biomass and the roots and soil.

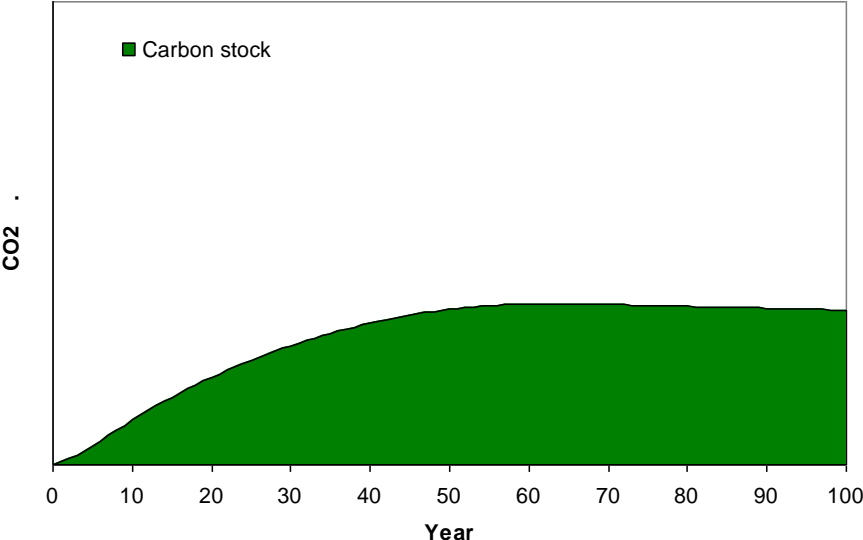


Figure 4: Biosequestration option without active carbon management

An alternative carbon mitigation strategy, involving active management of the stored carbon via bioenergy, is illustrated in Figure 5. In this alternative, the stand of trees (an energy crop)

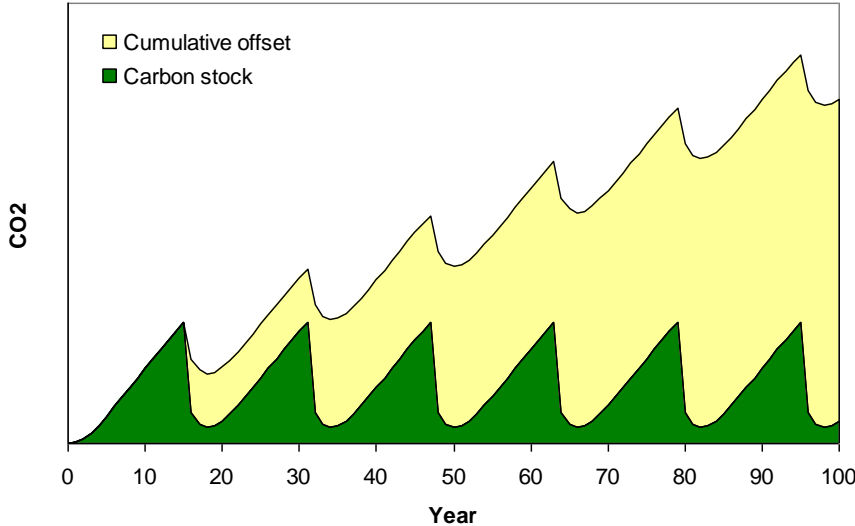


Figure 5: Biosequestration option with active carbon management via bioenergy

is harvested approximately every 15 years, with the harvested biomass used to offset fossil fuel (for heat, power and/or biofuels). The yellow area under the upper trajectory would be the cumulative carbon offset, while the dark green area represents the carbon stock. In this illustration the dark green area would include both above ground and below ground stored carbon.

It is very much in the national interest that the bioenergy alternative represented in Figure 5 be recognised under the Government's Carbon Farming Initiative, allowing credit for the standing biomass and subsurface carbon. This alternative may relate to short rotation, coppiced energy crops (where the trees are coppiced – cut off at ground level) every three to five years, with regrowth of the trees from the same root stock, or longer term plantation forestry established as an energy crop on a longer cycle, possibly involving digging up the roots. It is suggested that the CFI be integrated with biomass energy cropping to cater for the ongoing harvesting of a proportion of the crop.

Active management of carbon, as illustrated in Figure 5 needs to be recognised for both the displacement of fossil fuel use, and for simultaneous carbon sequestration. This point was made in a recent submission to the Department of Energy Efficiency and Climate Change addressing the Carbon Farming Initiative's consultation paper.

Converting the forestry biomass can utilise a variety of paths and technologies. The primary conversion processes are via thermal, biochemical or mechanical/physical processing.

Figure 6 illustrates the range of energy processing paths for converting biomass to energy, chemical feedstocks and liquid biofuels. These are briefly explained below, coupled with providing examples of the commercial status of several bioenergy technologies.

**Thermal** (or thermo-chemical) energy conversion is generally applicable to drier biomass, such as wood waste. The most familiar and commercially mature form of thermal energy conversion is combustion.

**Combustion** of biomass accounts for approximately 90 percent of the 52,000 MW of modern bioelectricity power plants world-wide, and is very similar to technology applied to solid fossil fuels such as coal. Excess air is applied for the combustion process to convert the biomass essentially to carbon dioxide and water vapour, liberating the stored energy in the biomass. Besides direct combustion, biomass can be co-combusted with coal in large utility boilers. Co-firing of biomass with coal is allowable under Australia's Renewable Energy Target (RET), if the biomass source itself complies with the relevant Regulation administered by the Office of the Renewable Energy Regulator. Combustion technologies are mature technologies and have some advantages in terms of a low technological risk and cost.

Examples of biomass combustion plants are the bagasse fired plants in the sugar industry, where for instance the Pioneer Mill in Queensland has 68MW of electrical generation. Other examples are the Rocky Point Sugar Mill cogeneration plant of 30 MW electrical capacity, and two 30MW plants recently commissioned at the Condong and Broadwater sugar mills on the NSW north coast. Co-firing has also been conducted at various Australian power stations, such as Liddell, Wallerawang, Muja power stations.

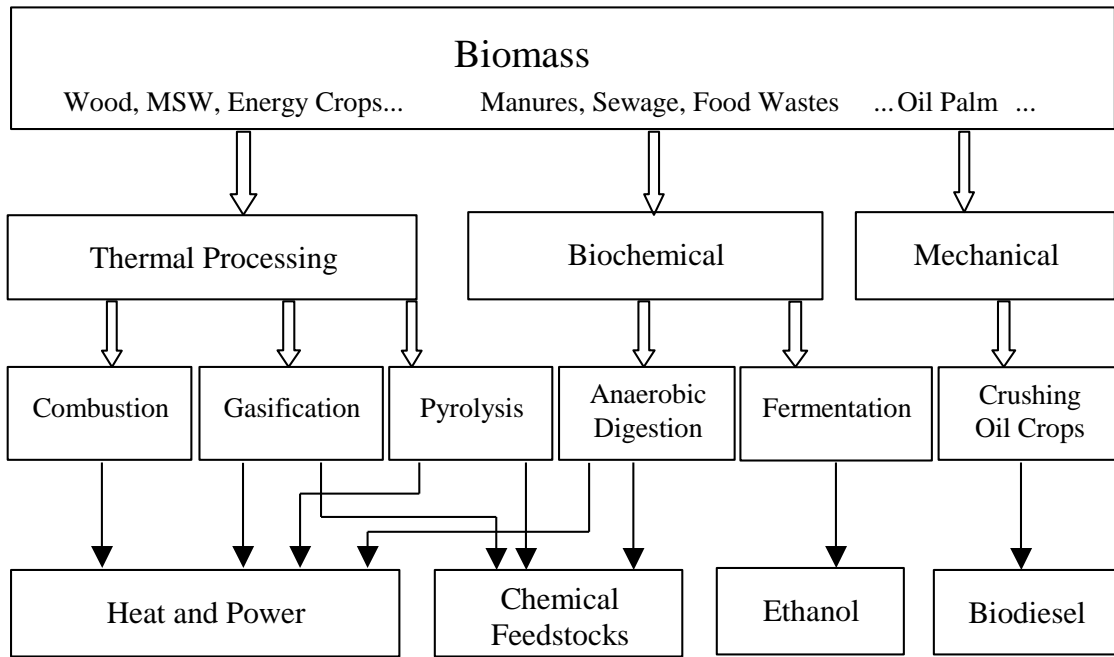


Figure 6: Bioenergy Conversion Routes

As an overseas example of a typical combustion bioenergy plant, Figure 7 shows an aerial photograph of the 36 MW Grayling Power Station in Michigan, USA. This plant operates on wood waste with steam conditions 510°C and 8.8 MPa.



Figure 7: 36.2 MW Grayling Power Station in USA (photo NREL)



The Cuijk Fluidised Bed Combustor (FBC) power plant in The Netherlands near the German border is a prime example of this technology. This 25 MW<sub>e</sub> wood-chip plant has a steam temperature of 525 °C and a pressure of 10 MPa. Figure 8 provides an aerial view of the Cuijk FBC plant. The two round buildings with conical roofs in the foreground provide covered fuel storage. Fuel is supplied by road and by barge. The plant uses dry cooling to condense the steam. As such, this plant uses minimal amounts of cooling water.



Figure 8: Aerial Photo of Cuijk 25 MW power plant (source Essent Energy)

One of the world's largest biomass boilers is at the Alholmens Kraft Power Plant on the west coast of Finland. The boiler has a capacity of 550 MW<sub>th</sub> and an electrical capacity of 240 MW<sub>e</sub>. This sophisticated plant incorporates reheating of the steam with superheater steam conditions being 545°C and 16.5 MPa, with reheat steam conditions being 545°C and 16.5 MPa. This power plant is in part supplied by slash bundle (tree harvesting logging waste) biomass railed to the power plant. Figure 9 provides an aerial view of the plant, with the 'slash' bundles at the bottom right of the photo.



(source: VTT)

Figure 9: Alholmens Kraft Bioenergy Plant in Finland



Figure 10 shows the turbine hall with the 240 MW steam turbo-generator.



(source: VTT)

Figure 10: Alholmens Kraft Turbine Hall Showing 240 MW Steam Turbo-Generator

A recent trend in some parts of the world is to use multifuel combustion energy plants, including use of biomass fuels. A prime example is the Avedøre 2 Combined Heat and Power (CHP) plant located just outside of Copenhagen, Denmark. This power plant opened in mid 2002. It has a multifuel capability, using both solid biofuels and natural gas. The biomass fuel consists of straw bales (200,000 tonnes per year) and wood pellets (300,000 tonnes per annum). The plant has an ultra super critical boiler with the steam conditions being 580-600°C and 300 bar (very similar to the Tarong North coal fired power station in Queensland). The overall plant efficiency is some 94% in combined heat and power mode. The pellets are



(source: E2 Energi)

Figure 11: Avedøre 2 Bioenergy Power Plant (taller unit)

manufactured at a nearby factory at Køge, mainly using imported logs and some are also imported, mainly from Sweden. The Køge pellet plant consists of 18 pellets presses. The main supplier of the CHP plant was Danish FLS Miljø. The output of the CHP plant is 570 MW<sub>e</sub> and 570 MW<sub>th</sub>. The Avedøre 2 unit is shown below (rear and to left) in Figure 11 adjacent to Unit 1 which is coal fired. During the design phase, Unit 2 was converted from coal firing to mainly biomass and natural gas. Biomass at times provides some 70 percent of the fuel energy of this Avedøre power plant.

**Gasification** uses a reduced amount of air or oxygen. In gasification combustible gases are liberated from the biomass, to produce a fuel or chemical feedstock. This gas is rich in carbon monoxide and hydrogen gases and can be used to fuel gas engines, gas turbines, or act as a chemical feedstock for the production of chemicals such as methanol or other synthetic fuels. The product gas is very similar to that produced from coal and reticulated around Australian cities before the advent of natural gas.

Biomass gasification is not as mature as combustion technologies, but has been deployed to a limited extent in Australia. For instance Forestry Tasmania has had a small scale wood gasifier accredited by ORER fuelling a compression ignition engine. Overseas in the USA and Europe biomass gasification has reached commercial scale demonstration, with plants having operated in Burlington Vermont, USA, Gussing in Austria, Värnåmo in Sweden. Biomass has also been co-gasified with coal at the flagship Buggenum gasifier in the Netherlands.

Biomass Integrated Gasification Combined Cycle (BIGCC) has been developed to maximise the energy conversion efficiency of biomass to electricity. In BIGCC gasified biomass powers a gas turbine, with the exhaust heat of the gas turbine raising steam to power a steam turbine. As such, electricity is provided by both the gas and steam turbines, resulting in overall higher thermal efficiency. In some instances heat is extracted from the BIGCC plant for district heating, raising the overall efficiency even further.

The world's first BIGCC demonstration plant was built in 1996 at Värnåmo in Sweden by the Finnish engineering firm Ahlstrom and the Swedish utility Sydkraft. The plant used a pressurised version of Ahlstrom's atmospheric pressure 'Pyroflow' circulating fluidised bed gasifier and supplied 6 MW of electricity and 9 MW of district heating. The air-blown gasifier operated at a temperature of 950-1000°C and 22 bar and incorporated a hot gas clean up system to remove tar and particulates. The gasifier was operated as a demonstration plant and clocked up some 8,500 hours gasifier operation and 3,600 hours BIGCC operation until the demonstration project was completed. Subsequently commercial considerations led to this plant being mothballed. This gasifier is now used for European Union research into producing liquid transportation fuels from gasified biomass.

Figure 12 provides an aerial photo of the plant shortly after it was commissioned.

**Pyrolysis** of biomass takes two forms, slow pyrolysis as traditionally applied to charcoal making, or fast pyrolysis (flash pyrolysis), which mainly produces a combustible liquid fuel which can substitute for diesel or act as a chemical feedstock. Fast pyrolysis can convert up to 75% of the mass of the dry biomass to bio-oil. Pyrolysis occurs in the absence of oxygen under controlled conditions. Pyrolysis bio-oil is quite different to petroleum diesel, having a much higher specific gravity (1.2) and other physical and chemical properties. Bio-oil has



Figure 12 : Värnamo BIGCC plant, Sweden

approximately 60 percent the energy density of diesel on a volume for volume basis, and has been developed to the stage where commercial projects are beginning to emerge, after some 20 years of bio-oil development.

A leader in the pyrolysis bioenergy area has been Canadian company Dynamotive, who have built a 100 tonne/day biomass (input plant) in Ontario, Canada, where the bio-oil powers a 2.5 MW combustion turbine. Australian company, Renewable Oil Corporation has acquired a licence from Dynamotive and are developing projects in Australia to implement this technology. Figure 13 shows the Dynamotive plant in Ontario, Canada, with the Orenda 2.5 MW combustion turbine in the foreground.



Figure 13: Dynamotive Plant in Canada (source: Dynamotive)

Much of the fast pyrolysis bio-oil development is now concentrated on upgrading the bio-crude to 'drop-in' liquid biofuels for transportation applications.

Australian companies such as Pacific Pyrolysis, Crucible Carbon, AnthroTerra are now developing pyrolysis technologies for the co-production of biochar and energy applications (mainly power). Biochar is seen as technology for sequestering carbon, while simultaneously providing a soil amendment to improve soil health and productivity.

**Biochemical** conversion of biomass uses microbes to convert the biomass into energy related intermediate products such as methane or ethanol. A common example of biochemical conversion occurs in landfills, where anaerobic organisms convert garbage into a mixture of methane and carbon dioxide, in roughly equal proportions. Often this combustible gas is captured and used for producing electricity in gas engines or turbines driving alternators. This technology is more attuned to wet wastes, with limited application for the forestry industry.

Some aspect of bioenergy that are worthy of note are:

- Bioenergy has an advantage over other forms of renewable energy such as wind and direct solar energy. As the energy bound into the biomass provides inherent energy storage, bioelectricity can be dispatched, providing firm capacity, unlike some other sources dispatched by nature. Additional energy storage is therefore not required for bioenergy. This allows excellent utilisation of the bioenergy plant's capacity. Many of the newer bioenergy plants have capacity factors in excess of 90 percent, on a par with coal fired units.
- Besides greenhouse gas abatement, a benefit of bioenergy that is of considerable interest in Australia is the combating of dryland salinity (e.g. in the Murray Darling Basin and in the WA wheatbelt). In Western Australia some 1.8 Mha of land is affected or is at high risk from dryland salinity. Without intervention this is expected to rise to 7.5 Mha by 2050, resulting in the loss of productive agricultural land. One way of addressing rising water tables and resulting dryland salinity, is through the planting of oil mallee eucalypts. Their deep roots act as water pumps, lowering water tables and mitigating the problem. To date some 30 million oil mallees have been planted for this primary purpose, and also for the provision of biomass for energy and other prospective value-added products. As such, tree crops can provide the dual function of providing landscape solutions in degraded landscapes as well as providing fuel for bioenergy. The Australian Conservation Foundation (ACF) produced a report 'Fuelling Landscape Repair' noting the merit of planting trees to rehabilitate land, and also providing an energy feedstock.
- There are employment opportunities from the ongoing requirement to source and provide fuel for the life of a bioenergy project (a 30 MW bioelectricity plant would require close to 300,000 tonnes of biomass per year). An assessment by IEA Bioenergy [6] indicates an employment level of some 180-500 person-years/TWh of fuel energy.
- Bioenergy was providing approximately 25% of surrendered Renewable Energy Certificates (RECs) under the MRET scheme, until the introduction of highly subsidised roof top solar photovoltaic and solar hot water systems distorted this scheme, which has now been split into the Large-Scale Renewable Energy Target and the Small-Scale Renewable Energy Scheme.

## Greenhouse Gas Balances of Bioenergy Systems

Life cycle analysis applies a methodical ‘cradle-to-grave’ assessment of a technology, within pre-defined system boundaries to assess the particular technology’s use of resources for its manufacture, use and eventual decommissioning. This assessment is generally applied to inputs as well as outputs associated with the technology. Of particular interest for various energy technologies are the life cycle emissions of ‘carbon dioxide equivalent’ gases.

Figure 14 shows the results from a UK Department of Trade and Industry study [7], partially based on an IEA study, comparing the life cycle emissions of carbon dioxide for various conventional and renewable energy technologies. On a life cycle basis, greenhouse gas emissions of bioenergy systems are project specific, but typically in the range 4-50 grams CO<sub>2</sub> equivalent/kWh. By comparison, photovoltaic technology is reported at over 150 grams CO<sub>2</sub> equivalent/kWh.

<b>Technology</b>	<b>g/kWh CO<sub>2</sub></b>
Brown Coal: Current Practice	1100-1300
Bituminous Coal: Best Practice	955
Gas: Combined cycle	446
Diesel: Embedded	772
Onshore wind	9
Hydro - existing large	32
Hydro – small-scale	5
Decentralised photovoltaic (PV)- retrofit	160
Decentralised PV – new houses	178
Decentralised PV – new commercial	154
<b>Bioenergy Technologies</b>	
Bioenergy – poultry litter - gasification	8
Bioenergy – poultry litter – steam cycle	10
Bioenergy – straw – steam cycle	13
Bioenergy –straw - pyrolysis	11
Bioenergy – energy crops - gasification	14
Bioenergy – Forestry residues – steam cycle	29
Bioenergy – Forestry residues - gasification	24
Bioenergy – animal slurry – anaerobic digestion	31
Landfill gas	49
Sewage gas	4

Figure 14: Life Cycle Carbon Dioxide Equivalent Emissions for various technologies (g/kWh) (adapted from [7]).

## Industry Issues

The Committee should be aware that there are a number of bioenergy projects that have not as yet gone ahead for a variety of reasons, mainly due to the low and uncertain market for bioenergy and also difficulties and cost associated with fuel supply. Examples of these plants are three 40 MW scale plants in Western Australia, two similar scale plants in Tasmania, and a plant in the Green Triangle in eastern SA/western Victoria.



The Committee’s attention is also drawn to a major publication from the Federal Government’s Rural Industries Research and Development Corporation entitled ‘Biomass Energy Production in Australia – status, costs and opportunities for major technologies, which may provide the Committee with added information of the prospects for bioenergy in Australia.

**Biofuels**

The present generation of biofuels are largely based on ethanol and biodiesel, which provide under one percent of current fuel requirements. In Australia ethanol is currently produced from starch wastes, molasses and sorghum grain, while biodiesel is mainly produced from waste vegetable oil, tallow and some virgin plant oils.

New technologies for producing biofuels are being developed world wide, based on gasification of biomass and synthesis to form fuels such as methanol, DME (dimethyl ether) and hydrogen. The advantage of this route is that yields of biofuel would be approximately twice that of current biodiesel and ethanol production on a per hectare basis i.e. 3,100 litres diesel equivalent per hectare per annum. These processes for converting biomass to fuels are shown diagrammatically in Figure 15 below.

Volkswagen in Germany has been trialling a fuel called Sundiesel™, which is produced via the gasification of biomass, and synthesis to a synthetic diesel via Fischer Tropsch technology. This concept is not too dissimilar to the very large oil-from-coal industry, long established in South Africa, but importantly based on renewable biomass feedstocks such as

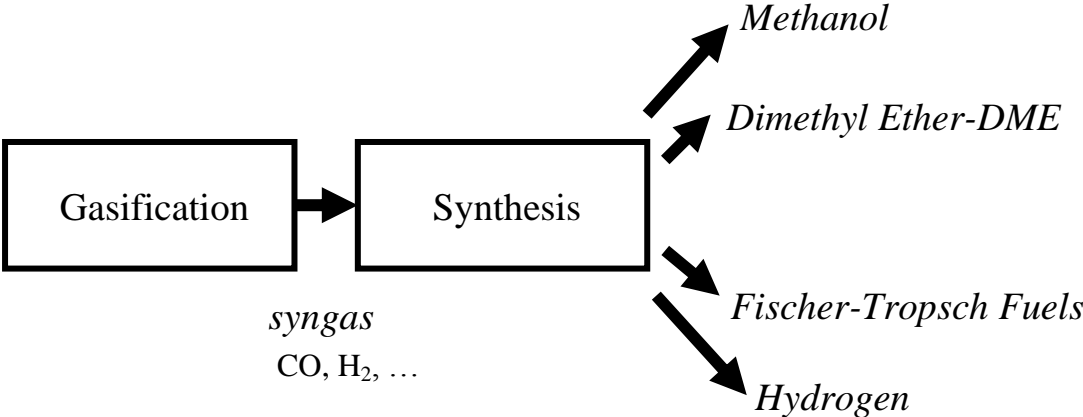


Figure 15: Thermochemical Biofuel Routes

wood. Similarly, Volvo in Sweden is developing Dimethyl Ether (DME) as a transport fuel. DME is similarly derived from biomass gasification, having properties not too dissimilar to LPG. The photo below in Figure 16 shows a Volvo DME truck being displayed at the May 2005 SYNBIOS conference in Stockholm.





(source: S Schuck)

Figure 16: Dimethyl Ether (DME) Truck on Display

Producing alcohol fuels from wood has been the subject of a Joint Venture Agroforestry study (*Wood for Alcohol Fuels – using farm forestry for bioenergy*), available from the Rural Industries Research and Development Corporation ([www.rirdc.gov.au](http://www.rirdc.gov.au)) as Project No. EPL-2A, Publication No. 03/018. This report examined the wide scale planting of mainly oil mallee eucalypts for salinity control, and using the coppiced biomass for methanol and ethanol production, either via the gasification route or via the hydrolysis of the biomass and fermentation of the cellulose and hemicellulose derived sugars to ethanol.

The Federally funded NCRIS (National Collaborative Research Infrastructure Strategy) Biofuels program, being managed by AusBiotech has provided research infrastructure at five institutions for developing advanced biofuels, including from woody biomass. This program comes to an end in June 2011, with no obvious ongoing funding for the continued operation of these facilities. It is suggested that further value be extracted from these biofuels research infrastructure to provide pathways for meeting future biofuels needs based on woody biomass.

Bioenergy Australia is the vehicle for Australia's participation in the International Energy Agency's Bioenergy Program ([www.ieabioenergy.com](http://www.ieabioenergy.com)). It is currently participating in four Tasks: Task 38 *Greenhouse Gas Balances of Biomass and Bioenergy Systems*, and Task 39 *Commercialising First and Second Generation Liquid Biofuels*, and Task 42 *Biorefineries: Coproduction of Fuels, Chemicals, Power and Materials from Biomass*, and Task 43 *Biomass Feedstocks for Energy Markets*. Such participation is exposing Members of Bioenergy Australia to the latest developments in bioenergy and contributes to the development of alternatives to fossil fuels.

Energy crops using tree species could provide the feedstocks for substantial biofuel industries (noting the above developments). Such industries, besides contributing to our future fuel mix and energy security, would stimulate rural economies and provide permanent jobs through the production of the biomass and the supply logistics.

### **Job Creation**

Bioenergy is known to have impressive economic multipliers, translating into employment opportunities, especially in rural and regional areas. Figure 17 from a European Union study shows the impressive job creation potential of bioenergy.

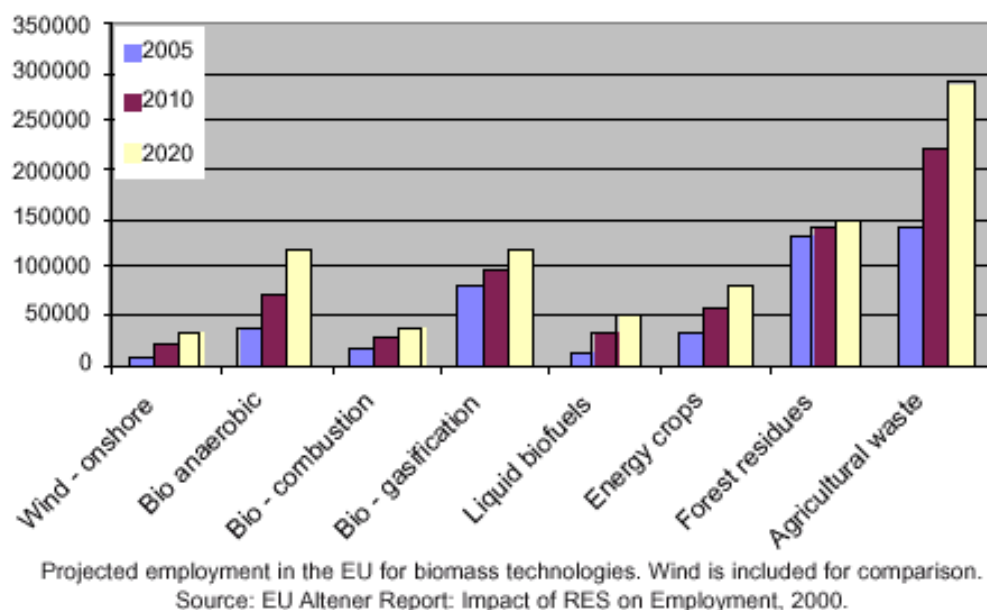


Figure 17: Employment from Bioenergy Technologies

## Conclusion

Globally the forestry industry provides much of the fuel for bioenergy. This opportunity has not been realised to any extent in Australia. Various studies have shown that bioenergy could provide a substantial proportion of Australia's stationary and liquid fuels needs, with sufficient support. This submission has been provided to bring to the Committee's attention what has and is being achieved overseas in this area, and what could be achieved in Australia.

Thank you for the opportunity of providing this submission. I would be most pleased to provide follow-up information and assistance to the Committee. This would hopefully lead to forestry bioenergy opportunities contributing significant capacity to the generation mix and to future fuel supplies in Australia in the near future.

Yours Sincerely

Dr Stephen Schuck  
Bioenergy Australia Manager

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- [2] International Energy Agency's Bioenergy program, *Bioenergy – A Sustainable and Renewable Energy Source – Main Report*, 2009. IEA Bioenergy publication ExCo:2009:06 At [www.ieabioenergy.com](http://www.ieabioenergy.com).
- [3] Clean Energy Council, *Bioenergy Roadmap*, CEC, 2008
- [4] Scale of biomass production from new woody crops for salinity control in dryland agriculture in Australia, *Int. J. Global Energy Issues*, Vol. 27, No. 2, 2007

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- [6] Danielsson, Bengt-Olaf. Employment Effects of Wood Fuel Harvesting, page 142 of IEA Bioenergy, *Forest Management for Bioenergy*, The Finnish Forest Research Institute, Vantaa, 1997.
- [7] *New and Renewable Energy: Prospects in the UK for the 21<sup>st</sup> Century – Supporting Analysis*, page 202. UK Department of Trade and Industry, March 1999.

Attachment:

- ‘Carbon Trading and Renewable Energy’ Bioenergy Australia and RIRDC publication 08/184 (electronic copy in pdf format)