

Inquiry into the development of a non-fossil fuel energy industry in Australia

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This submission is to put forward the need for due attention to be paid to the potential for bioenergy to provide a significant part of Australia's energy needs. In simple terms bioenergy is energy produced in some way from biomass, or organic material. For this submission the sub-categories and sources of bioenergy dealt with include -

- Heat and electricity produced by chipped timber harvest waste and thinnings and from industry off-cuts, waste and sawdust, and dry agricultural by-product (such as straw) used to fuel (or co-fire in a mix with coal, municipal flammable waste or gas) district heating plants or combined heat and power plants.
- Biogas produced from anaerobic fermentation of human and animal manure slurry, food processing wastes from industry, wet agricultural material including grass, and other organic waste. The biogas can be used as is, or cleaned and dewatered to produce 97% methane which can be used for vehicle fuel, heating, cooking or powering electricity generation.
- Products of high temperature/low oxygen pyrolysis of woody material, and the synthesis of the hydrogen-rich gases given off into vehicle fuels (and also some industrial chemicals).
- The breaking down by enzyme action of ligno-cellulosic material such as wood, straw etc to produce simple sugars which can be fermented to produce ethanol for vehicle fuel.

(Bioenergy can also encompass production of ethanol from fermenting feed grains and sugar cane, but as this is so thoroughly discussed I will leave it out of this submission, confining it to the energy able to be gained from biomass that is otherwise valueless waste by-product of industry)

Bioenergy from the above processes can not only provide up to 30% of the Australia's energy needs, but also due to the fact that it is largely produced from low-value waste products mainly of the timber and timber processing industries, it adds value to several industry sectors and has the potential to stimulate their expansion, and in doing so can provide an expanded range of benefits for rural and regional Australia. These include: more jobs in energy generation, timber management, the timber processing industry, biofuel production, a greater diversity in farm enterprises, and a number of significant environmental benefits.

The raw material for these energy-yielding processes is biomass. The use of biomass for energy in Australia is presently very limited. It is principally limited to the use of firewood, with some production of electricity and heat from gas produced from pig manure, some trialling of woodchip for co-firing of coal fired power stations, some trials of small chip-fuelled gasifiers producing electricity.

Overall vast amounts of biomass are wasted every year. Forest harvest waste and straw are normally burnt or allowed to just degrade. Plantation waste is allowed to degrade in an uncontrolled process with production of carbon dioxide and methane. Animal manures are disposed of in uncontrolled ways. Timber processing waste is put in landfill or used for animal bedding and then burnt. Food industry waste is usually dumped or fed to livestock. Wet domestic waste is put in landfill.

The outcome of all this is that Carbon dioxide and other greenhouse gases are released, adding to our already high national emissions to no benefit. Their bioenergy value- the potential of their heat or flammable products that could substitute for fossil fuel energy - is lost. The total energy presently involved is vast, at least 10,000 MWe every year (or the power usage of Victoria), where the entire power consumption of the country is about 60,000 MW.

With a more organised use of the energy embodied in biomass Australia's Greenhouse gas emissions would therefore be substantially reduced.

(note – the term power is used for electricity, while the term energy denotes heat and electricity)

As described in one of the accompanying articles, the countries of northern Europe and Scandinavia have taken a far more thoroughgoing approach to making better use of biomass. Some examples -

- sawdust from processing industry is pelleted and sold into high demand for heating systems for apartments and institutions
- harvest waste is chipped or bundled into 'logs' and sold to biomass fuelled energy plants of up to 500MW capacity
- many timber processing industries use the waste product to produce heat and/or electricity for their own energy needs.
- conifer stumps from forest final harvest are chipped for fuel for bioenergy plants.
- straw is baled and either used to fuel energy plants or may be added to wet biomass for fermenting into biogas
- human and/or animal manure is fermented along with other organic waste to produce biogas, which may be dewatered and cleaned to become methane and used as a vehicle fuel or for heating or power generation.

To use Sweden as an example of how production of bioenergy can work, the present production of energy from biomass provides 25% of all Sweden's energy needs. The great majority of this is from the district heating plants and combined heat and power plants that are in many communities.

In 2004 61% of all district heating plants were fuelled with biofuels.

For private houses not on any district heating system about 10 TWh of energy was from biofuels – mostly as firewood (by contrast the electricity from Sweden's nuclear power plants which produce 50% of electricity is about 70TWh).

37,000 houses that are not supplied from any district heating plant, are heated by pellet-fuelled heating systems.

Biogas production is over 16 million Nm³. This fuels thousands of cars and city fleet vehicles, and is used for cooking, heating and power generation.

To stimulate a better use of bioenergy in Australia.

The key areas of opportunity in Australia are

- **In better use of the thinnings and harvest waste** of hardwood and soft wood plantations, and native forest operations. Currently one 40MW biomass fuelled power plant is in development for Bridgewater WA, to use bluegum plantation harvest waste. Others could follow at sites in WA Victoria and NSW, wherever a combination of wood waste, municipal flammable waste, straw, and other forms of dry organic matter are available in sufficient ongoing quantities. District heating plants can be as small as one MW, and with combined heat and power plants usually more than 10MW and up to 350MW.
- **In more efficient collection** of animal manures, food processing wastes, wet agricultural wastes and municipal organic waste for anaerobic fermentation to produce biogas. For example one piggery near Ballarat with 20,000 pigs produces enough manure to produce 2700m³ a day of biogas. This powers a motor/generator set-up producing 220 KW of electricity. The waste from this process is carbon dioxide, a far less harmful greenhouse gas than the methane that is the normal product of manure breakdown. The manures from most indoor piggeries, dairies and hen and chicken operations presently goes to methane.
- **In research** into both high temperature pyrolysis of woody biomass, and enzymatic breakdown of ligno-cellulosic material to simple carbohydrates. Both processes are potentially a far more cost-effective and energy-efficient way to produce vehicle fuels than the production of ethanol from food grade grains or sugars

The countries that are successful in developing these bioenergy options have done so through targeted stimulation of these new industry sectors. This has been done by a combination of

grants and low interest loans, support for education and research, and long-term development strategies under-pinned by legislation.

In Finland for instance each of the 13 forestry regions has two or three bioenergy specialists working with the local authorities to increase awareness and adoption of bioenergy. In some areas of Finland almost all communities have their heating needs supplied from biomass fuelled district plants. Half of the energy used by the timber processing industry is generated within the plants from waste woody biomass. Finland's universities are leading the world in education and training of specialists and researchers in bioenergy. Industry is at the cutting edge of design of bioenergy plants, and monitoring systems. The Finns are world leaders in the technology of thinning, harvesting, and processing wood, and in making and selling the machinery designed to do it all.

For the Swedes the bioenergy sector is their eighth largest export sector and their fastest growing. They realise that the costs of bioenergy are less than for the other renewables, while it provides greater environmental benefit and ongoing rural jobs. While the feed material is low value waste the valuable products are electricity, heat, fuels and industrial chemicals.

Australia could benefit greatly from similarly developing a far greater use of these biomass by-products we currently waste. It offers a cost-effective way of reducing our emissions of greenhouse gases.

The recommendations of this submission for how to assist development of the Bioenergy sector, within the non-fossil fuel energy industry is that state and federal governments should –

1. Recognise the potential for this sector as providing a significant base-load, greenhouse neutral, cost effective, environmentally safe energy source suited to decentralised energy supply at all scales, coupled with broad environmental benefits.
2. Accept that the benefits of this sector should be fostered, and that whole life cycle economics and spin-off benefits warrant its development, including within the context of an expanded dispersed plantation industry, and better management of native forest.
3. Move to extend the certificates or rewards applying to electricity generation from renewable sources to include heat production by bioenergy and other renewables for industrial or domestic purposes, since this heat energy can replace heating by electricity produced from fossil fuel power stations.
4. Give some initial tax benefit to businesses that can undertake to establish bioenergy plants in areas of need of power or heat, where this will add to capacity, take load off the present power system, and reduce use of fossil fuels for power generation.
5. Provide incentives to existing power plants to co-fire with some fraction of woodchip where this is available economically.
6. Provide incentives to municipalities to establish or convert existing plants to co-fire woody biomass with flammable municipal waste, where both are available in adequate quantities.
7. Provide incentives to businesses producing significant volumes of biomass as waste to develop the supply of this biomass into the appropriate local bioenergy plant.

8. Provide grants to research centres to develop Australian designs for, or to local businesses to enter into joint ventures for, pellet making, biogas plants, biomass fuelled plants, high temperature pyrolysis systems, and ligno-cellulosic enzymatic breakdown systems.
9. Support the development of dispersed integrated farm forestry where this will improve environmental outcomes, boost regional enterprises, produce quality timber, and add volumes of biomass into local plants.
10. within any emissions trading scheme or greenhouse emissions cap scheme, consider how rules will impact on the development of the bioenergy sector, and word them accordingly to assist the development of the sector.

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