

Gasification



FARM TREES ⚡
FOR ENERGY!

A study into farm-scale
electricity production from trees

UNDERTAKEN BY FFORNE 2009

What is Gasification?

Gasification is the high temperature *conversion of wood into a combustible gas fuel mixture* containing hydrogen and carbon monoxide. Depending on the type of production, the gas mixture generated may be known variously as “wood gas” or “producer gas”.



Why Gasify Wood?

Converting wood into a combustible gas *provides a renewable source of energy*. Wood gas can be used as an alternative fuel for internal combustion engines, which in turn have applications such as providing stationary power for uses such as pumping water, powering generators to produce electricity and also for transport.



History of Gasification

Producing gas from wood is not a new technology. In 1839 the German chemist, Bischof, developed the first known gas producer.

In Europe in 1903, a 25-horsepower car powered by a gas producer travelled a distance of 1600 kilometres, however, the convenience of gasoline fuel soon eclipsed any general use of producer gas in vehicles. Fuel shortages during the Second World War gave renewed interest in gasification and by 1943, more than 45,000 gas producer vehicles powered by charcoal were in service in Australia.



The current focus on renewable energy has rekindled the interest in gasifiers, and with the addition of new technologies, the use of gasifiers for small and large scale energy production will be an important option for the future.

Conversion of Wood to Electrical Energy

The gasifier used in our project was a “Tasman Class” unit which was coupled to an electrical generator with a 15kW output. ***To produce the 15kW of electrical output, the gasifier consumes approximately 20 kg of wood/hr.***

As well as electricity, the process of gasification produces large amounts of heat. If the heat generated during the gasification process can be fully utilised, then the process becomes more efficient and ultimately will increase its economic viability.



Gasifier Fuel

Small scale gasifiers such as the Tasman Class gasifier require fuel to be chunky, about the size of a matchbox.

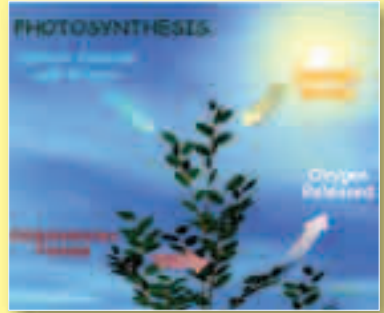
This allows air to flow around the material to encourage complete conversion to gas. The project identified that ***conventional wood chippers produced chips that were too small for the gasifier to function effectively.***

A search for suitable chipping equipment determined that a screw auger chipper produced chips of a suitable size and quality. Field tests confirmed the suitability of these chips for use in the Tasman Class gasification unit.



Environmental Benefits

Using the process of photosynthesis, trees use the energy from the sun to capture carbon dioxide and store it in a solid form within their wood. In the process **plants take this light energy and convert it into chemical energy** in the form of carbohydrates.



Gasification is the process of releasing the energy stored within the wood and turning it into energy in the form of a gaseous fuel.

Gasifying wood to produce energy is a carbon-neutral process. The carbon captured by trees during photosynthesis is released during gasification, thereby creating a cyclic process. Growing trees in plantations will ensure a continual supply of wood for energy.



When areas within a plantation are rotationally harvested, a **large bank of permanently stored carbon can be maintained**, thereby contributing to a reduction in greenhouse gases.



By-Products

One of the by-products of gasification is biochar. Biochar is creating interest as a method of soil carbon storage as well as being recognised as a valuable soil ameliorant. Biochar is formed during the reduction phase of gasification, when small particles of charred material fall through the grate. About 10% of fuel wood ends up as biochar. The production of biochar can be varied (increased) and will depend upon the internal design of the gasifier.



The Future for Gasification

Gasification of wood is just one of many methods for producing renewable energy and of converting biomass to energy. This project has actively pursued small-scale gasification and recognises that it has a role for “on-farm” use. Small scale gasifiers can be used to supplement peak electrical demand on farms such as at milking time, for irrigation pumping or for other purposes where for short periods electrical demand is high. If more electricity is being produced than is being consumed, excess electricity can be fed back into the grid. Gasification systems can be a viable option for situations where electricity is required in remote locations and grid connection is either too difficult or too costly.



FARM TREES FOR ENERGY!

The "Farm Trees for Energy" project aims to increase community awareness and interest in the potential to produce energy, particularly electricity, from farm plantations.

Project Proponent

FFORNE Hardwood Co-operative

www.fforne.com.au



Project Participants

Gasification Australia

www.gasificationaustralia.com.au



TreeSmart

www.treesmart.com.au



Department of Primary Industries

www.dpi.vic.gov.au



Industry Capability Network Victoria

www.icn.vic.org.au



Plantations North East

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