IEA Bioenergy

Task42 Biorefining in a Future BioEconomy

Australia Country Report

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Geoffrey Bell, CEO, Microbiogen Pty Ltd

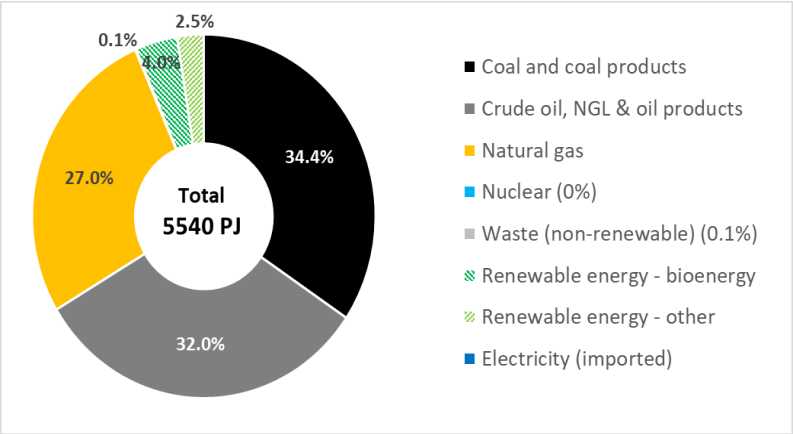
Content

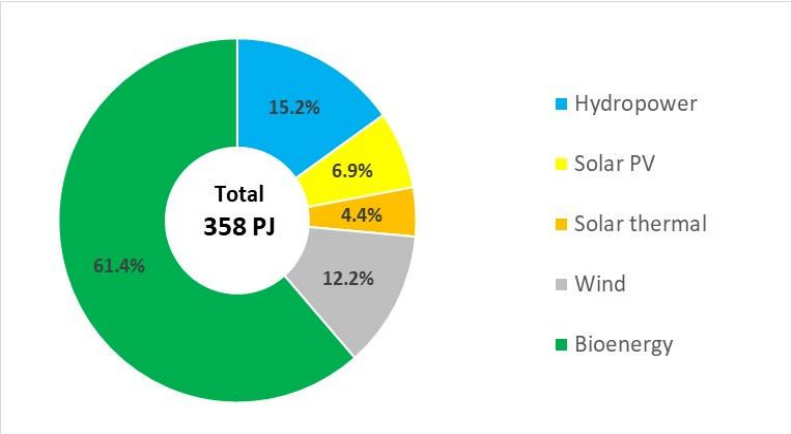
1. Total primary energy supply (TPES) and the role of bioenergy*
2. TPES from bioenergy and trend in evolution*
3. Biomass use for non-energetic purposes
4. Biorefinery targets, policies and legislation
5. Biorefinery related funding programmes
6. Commercial biorefinery facilities
7. Regional initiatives
8. Demo and pilot plants
9. Major innovation activities
10. Major stakeholders

* Figures to be copied from "IEA Bioenergy Countries' Report" [ExCo 2016.03]; will be regularly updated

1. Total primary energy supply (TPES) and the role of bioenergy*

Bioenergy in Australia accounts for approximately 8% of renewable power and 1% of total Australian power generation





- TPES AUS (2016): 5,540 PJ
- Dominated by fossil fuels: 5,178 PJ (93%)
- RES: 361 PJ (6.5%)
- Nuclear: 0 PJ (0.0%)
- Imported Electricity: 0 PJ (0.0%)

- 226 PJ (61%) of the primary energy supply for RES is covered by energy from biofuels and waste
- Sun and wind: 23%
- Geothermal/hydro: 15%

1. Total primary energy supply (TPES) and the role of bioenergy*

On a per capita basis bioenergy in Australia only 4% of total energy use. The residential sector has the greatest penetration of renewable energy at nearly 29%

Total energy	230 GJ/capita
Bioenergy	9.1 GJ/capita
Solid biofuels	7.9 GJ/capita
Renewable MSW	0.0 GJ/capita
Biogas	0.9 GJ/capita
Liquid biofuels	0.3 GJ/capita

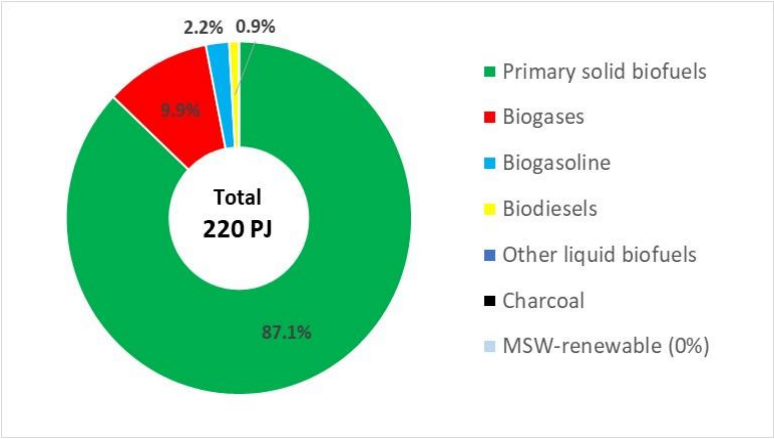
Sector	Share of bioenergy	Share of renewable energy	Overall production/ consumption
Electricity production	1.4%	14.7%	37.7 TWh
Transport energy (final consumption)*	0.8%	1.0%	1,361 PJ
Overall fuel and heat consumption[1] *	14.9%	16.2%	1,131 PJ
Fuel and heat consumption in the residential sector *	22.1%	28.5%	225 PJ
Heat output, generated by CHP plants and heat plants	n.a.	n.a.	n.a.

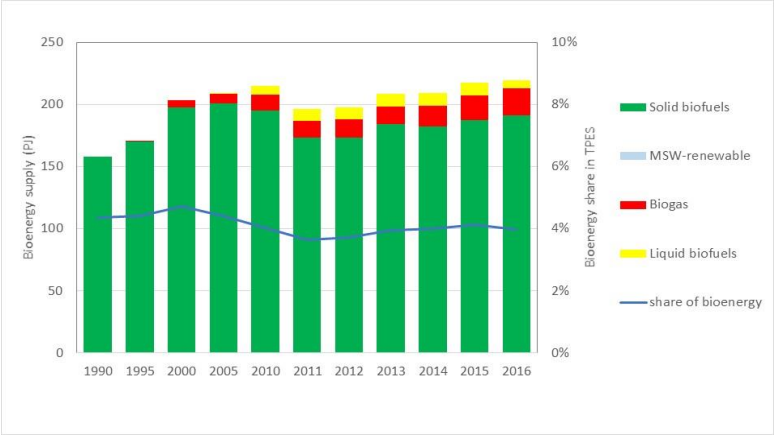
** 2015 figures; distribution not available yet for 2016*

(Source: World Energy Balances © OECD/IEA 2017)

2. TPES from bioenergy and trend in evolution*

Overall bioenergy supply in Australia has increased marginally over the last 15 years.





Bioenergy consumption (2016): 220 PJ

- Renewable MSW: (<1%)
- Solid biofuels: 191 PJ (87.1%)
- Biogas: 22 PJ (9.9%)
- Biodiesel: 2.0 PJ (1.0%)
- Biogasoline: 4.8 PJ (2.2%)
- Charcoal: (<1%)

AUS population (2016): 24.1 million people

- TPES/capita (2016): 230 GJ
- 4.0% from bioenergy

3. Biomass use for non-energetic purposes

Biomass is used widely in Australia for non-energetic purposes. Industries that use biomass for non-energetic purposes include:

- Paper and Pulp manufacturing
- Grain food production
- Silage for animal feed
- Sugar cane to crystal sucrose. Note that the bagasse is typically converted into energy but often inefficiently
- Composting waste biomass to generate a soil enhancing product
- Biomass left on field for soil conditioning

4. Biorefinery targets, policies and legislation

Australia does not have a formal bio-refinery target. However, it does have policies and legislation to encourage bio-refinery development

- In January 2017, the Queensland Government introduced a "biofuel" mandate. That is, 3% of all unleaded fuel must have 3% bioethanol. The mandate will increase to 4% from July 2018.
- New South Wales has a 6% bio-ethanol mandate. However, it is currently not being achieved but the Government is looking towards policies that will help.
- The Federal Government did have a carbon pricing scheme but this was revoked in 2014 by the Abbott Government.

4. Biorefinery targets, policies and legislation

Federal Government Programs

- **Large-scale Renewable Energy Target (LRET):** Established in January 2011, the LRET creates a financial incentive for the establishment or expansion of renewable energy power stations such as wind and solar farms or hydro-electric power stations. The Government has legislated demand for Large-scale Generation certificates (LGCs). These LGCs can then be sold by large power producers to typically energy retailers who surrender them to the Clean Energy Regulator.
- **Small-scale Renewable Energy Scheme (SRES):** This is designed for households, small business and community groups to install small scale renewable energy systems such as solar water heaters, heat pumps, solar PV systems, small scale wind and small scale hydro. Small scale technology certificates are created at the time of installation depending upon the size of the system. The SRES ends in 2030.

4. Biorefinery targets, policies and legislation

Federal Government Programs (cont…)

- **Emissions Reduction Fund (ERF):** Is a voluntary scheme that aims to provide incentives for a range of organisations and individuals to adopt new practices and technologies to reduce their emissions. These include:

  Carbon Credits (Carbon Farming Initiative) Act 2011

  Carbon Credits (Carbon Farming Initiative) Regulations 2011

  Carbon Credits (Carbon Farming Initiative) Rule 2015

- A number of activities are eligible under the scheme and participants can earn Australia Carbon Credit Units (ACCUs) for emissions reductions. Each ACCU can be sold to generate income either through the Government or the secondary market. To ensure emission reductions are not displaced significantly by rises elsewhere in the economy there is a safeguard mechanism which encourages large organisations to keep emissions within historical levels.

5. Biorefinery related funding programmes

Australian funding for clean energy is primarily federally based and comes under two key programs

Clean Energy Finance Corporation: This is an independent Government owned corporation that focuses on investment and helping to secure investment in renewable energy, energy efficiency and emissions technologies. It can and has helped investment in developing bio-refineries in Australia. It has access to over A$1B for funding.

Australian Renewable Development Agency: ARENA supports projects through early stage R+D to pre-commercial development. It was established in 2012 and is funded through to 2022.

6. Commercial bio-refinery facilities

Currently the largest operating commercial bio-refineries include:

- **Manildra**: Location is in NSW and capacity is approximately 260,000 liters of bioethanol per year. Substrate is typically waste starch streams
- **Sarina**: Location is in Queensland and capacity is approximately 60,000 liters of bioethanol per year. Substrate is molasses and the company sells a nutrient rich dunder to local farmers as fertilizer.
- **Dalby**: Location is in Queensland and capacity is approximately 85,000 liters per year. The substrate is starch sorghum and a by-product is the protein enriched distillers grains.

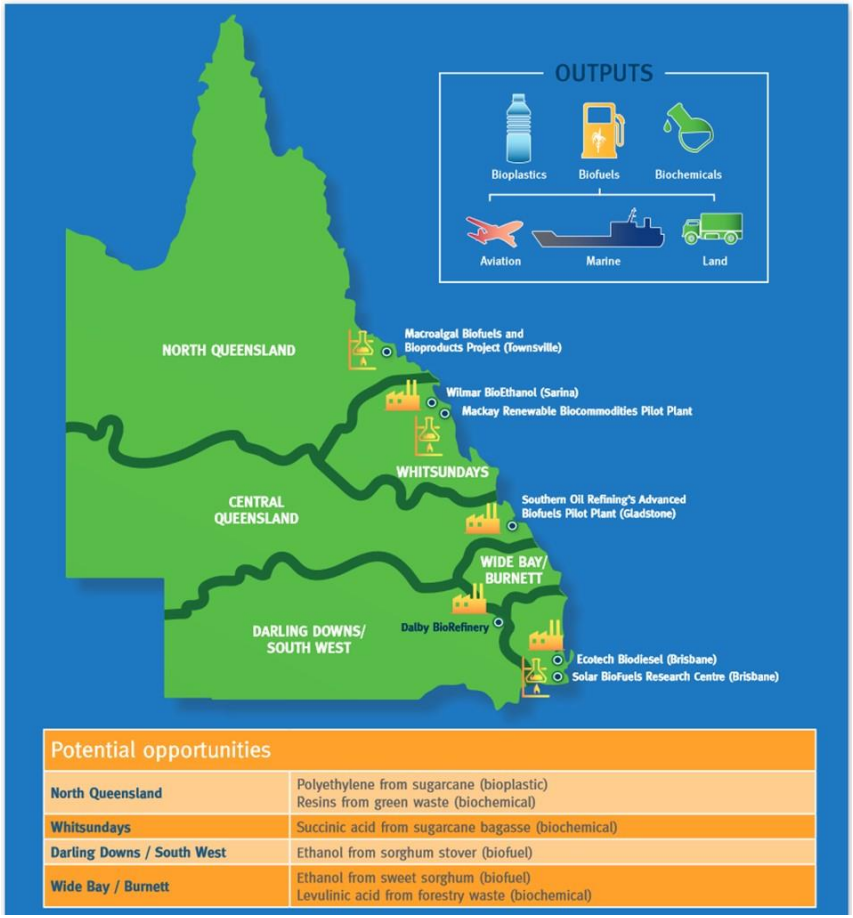
7. Regional initiatives

The Queensland Government is taking an aggressive approach to developing its future as a leading bio region in Australia.

- Queensland has a natural advantage as a bio hub with suitable climate, large areas of high biomass potential and regions ripe for further development.
- In June 2016, the Queensland Government released its "Queensland Bio-futures 10-year Roadmap and Action Plan"
- The action plan envisages a $1 billion sustainable and export oriented industrial bio-technology and bio-products sector within 10 years.
- The Government envisages a wide range of products such as sustainable chemicals, fuels, cosmetics, detergents and textiles amongst others.

8. Demo and pilot plants - Queensland

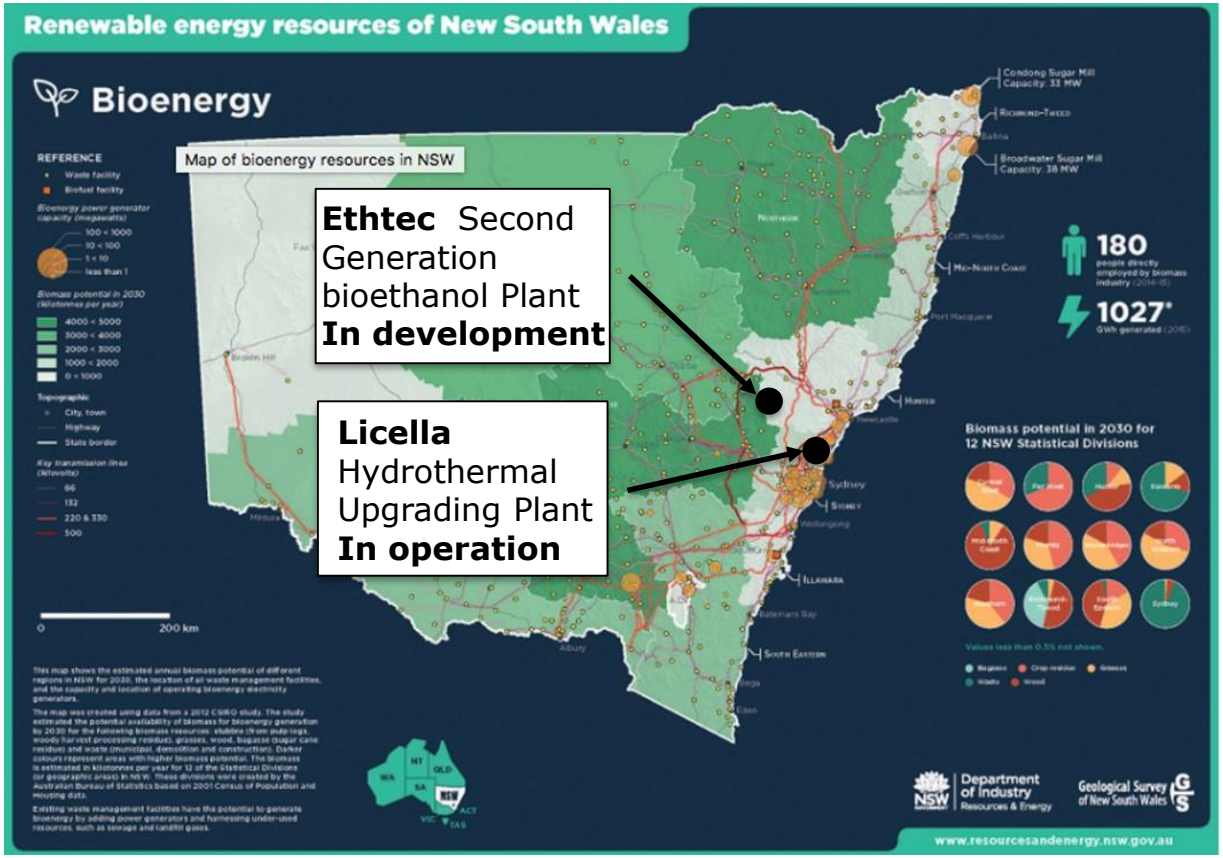
In Queensland where much of the pilot and demonstration work is being carried, there are a number of operations



Potential opportunities	
North Queensland	Polyethylene from sugarcane (bioplastic) Resins from green waste (biochemical)
Whitsundays	Succinic acid from sugarcane bagasse (biochemical)
Darling Downs / South West	Ethanol from sorghum stover (biofuel)
Wide Bay / Burnett	Ethanol from sweet sorghum (biofuel) Levulinic acid from forestry waste (biochemical)

8. Demo and pilot plants – New South Wales

In New South Wales there are two demonstration plants developed or being developed.



9. Major innovation activities

There are a number of private and publicly supported innovation activities occurring in Australia at present. Some of these include

- **Southern Oil – Advanced Biofuel Plant**. An $18M pilot plant that will convert biomass and waste material such as bagasse and Prickly Acacia as a feedstock for the production of bio-crude oil prior to refining to kerosene and diesel products. An aim of the project is to produce 1 million liters of fuel for field trials be the US Navy and its Great Green Fleet initiative.
- **Microbiogen – Optimised 2nd Generation Biofuel Yeast**. The Australian Government via ARENA is supporting Microbiogen in its collaboration with Novozymes A/S for a yeast that will significantly enhance the yields and economics of 2nd Gen biofuel facilities. Microbiogen alone will spend A$8M on the project over 3 years.

9. Major innovation activities - continued

- **Licella – Hydrothermal Upgrading Plant**. Over the past 10 years, Licella™ has used its large scale plant located in NSW to refine its Cat-HTR™ process for optimal yield, product quality and economics. This has involved three separate scale-ups of our Cat-HTR™ technology, resulting in the construction of the current Large Pilot Plant. The final scale up to a commercial scale module is only a x 2.2 scale up of the existing Large Pilot Plant reactors.
- **Ethtec Technologies Limited – Advanced 2nd Generation Bioethanol.** Ethtec has developed an innovative and cost-effective approach to production of bioethanol from a range of waste or low-value products including sugarcane bagasse, forestry residues and cotton gin trash known as lignocellulosic biomass. Total cost to built and operate the demonstration/pilot plant is estimated at A$48M. Construction is expected to start in 2018.

9. Major innovation activities - continued

- **Qantas Australia – Renewable Jet Fuel.** In late 2017, Qantas announced that its flights from Los Angeles will be powered by biofuel from 2020. This will be made possible an an agreement with SG Preston. Qantas has agreed to purchase 30 million liters of renewable jet fuel for a 10 year period. The fuel will be a 50:50 blend of conventional fuel and renewable fuel produced from non-food plant oils. It is believed that the renewable fuel will produce only half the emissions on a life cycle basis.
- **Virgin Australia – Gevo**. Gevo has announced that it will send alcohol to jet (ATJ) fuel from the US to Brisbane in 4 batches over 2 years for a jet fuel trial. The fuel will be produced from isobutanol in the US and then converted into jet fuel and shipped to Australia. This trial could potentially be the first step in a project to build renewable jet fuel capacity in Australia (Queensland)

10. Major stakeholders

Major stakeholders include:

- Australian Renewable Energy Agency
- Clean Energy Finance Corporation
- Manildra Group – Nowra Starch Bio-Refinery
- Wilmar – Sarina Bio-Refinery
- United Petroleum – Dalby Bio-Refinery
- Southern Oil Refining – Southern and Northern Refineries
- Microbiogen – Sydney Laboratories
- Queensland Government via Bio-Futures program
- Leaf Resources – Queensland based ASX listed company with unique glycerol pre-treatment technology
- Licella – Production of Bio-crude from waste biomass

10. Major stakeholders cont…

Major stakeholders include:

- Ethtec Technologies Limited – Development of concentrated acid pretreatment of biomass for bioethanol production

Other issues

New industry initiative:

- **National Liquid Biofuels Committee**: In early 2018, Bioenergy Australia convened a group of Australian experts in the field of biofuels. The committee is expected to carry out some of the following tasks:
- Have in the one place a group of experts that can influence and answer questions with respect to biofuels in Australia. The committee has expertise in a range of areas from bioethanol, biodiesel, production, distribution, policy etc.
- Develop a united policy position to advocate for the development and expansion of biofuels in Australia.
- Members of the group have already released its first review of the industry, highlighting the potential for biofuels in Australia to add thousands of jobs and add billions of dollars to GDP.

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Contact Details

Geoffrey Bell

CEO Microbiogen PTY Ltd

geoff.bell@microbiogen.com

IEA Bioenergy Website
www.ieabioenergy.com

IEA Bioenergy Task42 Website
www.task42.ieabioenergy.com