

Country Report Australia IEA Bioenergy Task 42

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Energy production and consumption based on biomass

The current energy production and consumption:

In 2009-10 Australia produced 17291 PJ of primary energy.

In 2009-10 Australia consumed 5945 PJ of energy (Total Primary Energy Supply).

The current production renewable energy and energy from biomass:

In 2009-10 Australia produced 193 PJ of energy from biomass, which constituted 1.1 per cent of total primary energy produced. All of this biomass can be regarded as renewable.

In 2009-10 Australia imported 0.67 PJ of biodiesel, which constituted about 22% of the domestic Australian market for biodiesel.

In Australia, most biomass is used within the food, beverages and tobacco industry, the wood, paper and printing industry and the residential sector. Sugar mills predominately use biomass in the form of bagasse for CHP production. CHP production also takes place in paper mills, using biomass in the form of wood waste. While decreasing in recent years, the residential sector also consumes wood and wood waste for heating. Partly reflecting this declining trend in residential biomass consumption, total Australian biomass consumption has declined, on average, by around 1 per cent a year since 1999-2000.

For current bioenergy energy production a breakdown is given in table AUS1.

Table AUS1. Current bioenergy production in Australia

Use	Year	Unit	Amount	% of total bioenergy	Feedstock(s)	Number of plants
Power	2009-10	PJ	75.069	35.3	bagasse, wood and wood waste, landfill gas, sludge biogas, other biomass	64
Heat	2009-10	PJ	126.6	59.5	bagasse, wood and wood waste	NA
CHP						
Bioethanol	2009-10	PJ	5.52	2.6	waste wheat starch, sorghum and C grade molasses (from sugar production).	3
Biodiesel	2009-10	PJ	2.26	1.3	mainly tallow and used cooking oil and small amounts of canola oil.	4
Biogas	2009-10	PJ	3.18	1.6	landfill biogas and sludge biogas	NA
Other		PJ				

Table AUS2. Breakdown of national biomass energy use on feedstock

Source	Year	Unit (Mm ³ or kton)	Amount	% of biomass energy reported above
Round wood				
Forest wood chips				
Wood industry residues				
Wood pellets/briquettes				
Black liquor and sludge				
Wastes (organic fraction)				
Straw/agricultural residues				
Sugar beet/sugar cane	2009-10	kton	9192	46
Cereals (grain, corn)				
Other				

The remaining 54% of biomass production for energy use is that associated with wood or wood waste and is estimated to be 6381 ktons.

Biomass used for non-energy purpose

Table AUS3. Use of biomass for non-energy purpose

Use	Year	Unit	Amount
Wood for particle boards (includes hardboard, softboard, particleboard and medium density fibreboard)	2009-10	'000 m ³	1 089
Wood for paper and paperboard	2009-10	'000 m ³	6 476
Wastes from pulp and paper			
Chemicals from biomass			
Cereal production (figures may include small tonnage for energy purposes)			
Barley	2009-10	kt	7 865
Oats	2009-10	kt	1 162
Wheat	2009-10	kt	21 834
Grain sorghum	2009-10	kt	1 508
Sugar production			
Starch production			
Oilseed production			
Algae production			

Policy issues related to biomass, bioenergy or biorefineries

Biofuels

The Australian biofuels industry is small and primarily focuses on the domestic market. The industry currently supplies approximately half a per cent of the domestic transport fuel market and ranks as the second most widely available alternative fuel in Australia. Approximately 20 per cent

of Australia's retail fuel distribution outlets provide options to purchase fuels which are blended with biofuels, mainly E10, which is a blend of 10% bio-ethanol with 90% petrol.

Australia has three operating ethanol production plants and five operating biodiesel production plants. Ethanol production in 2009-10 was 269 ML. Biodiesel production in 2009-10 was estimated at around 69 ML, with additional imports of approximately 21 ML.

Australian Government's biofuels industry policy

The Australian Government believes that a range of alternative fuel sources and technologies are required to minimise reliance on imported oil, improve fuel security and reduce greenhouse gas emissions. However, the Government does not have a specific policy target for biofuels.

The main Government assistance for alternative transport fuels is via a concessionary excise regime which provides effective excise free status for alternative fuels. This arrangement was to cease on 30 June 2011 but the Government has announced its intention to extend the current regime until 30 November 2011. The Government's policy is that from 1 December 2011, excise will be phased in for non-renewable alternative fuels on an energy content basis with a 50 per cent discount. Renewable fuels, which include biofuels, are to remain excise free for an additional ten years until at least 2021 under this policy.

The Australian Government is currently undertaking an Alternative Transport Fuels Strategy Assessment to examine issues relating to industry structure, technology, infrastructure challenges and public acceptance of alternative fuels in Australia. This document will become a core input into the Energy White Paper development process, for which one of the key objectives is to strengthen Australia's long term transport energy security by diversifying the fuel mix through the increased availability and consumption of alternative fuels.

Fibre-based bioproducts including production from biorefineries

In June 2009, the Australian Government established a Pulp and Paper Industry Strategy Group to undertake a review of Australia's pulp and paper manufacturing industry. The final report of this Strategy Group led to the establishment of the Pulp and Paper Industry Innovation Council which is considering a broad range of issues including:

- the development of Terms of Reference for an appropriately funded Biorefinery Research Institute
- the production of fibre-based biofuels
- innovation and R& D opportunities for the production of fibre-based bio-products (materials, chemicals and fuels), including high value specialty products and innovations to fit local requirements
- opportunities for collaboration with related industries such as sugar and starch.

Biorefinery related funding programs

Funding for biofuels research infrastructure is provided through two Federal Government initiatives: the National Collaborative Research Infrastructure Strategy and Super Science Initiative.

The total Commonwealth funding under these two initiatives during the period September 2007 to June 2012 is \$10,980, 000.

Commonwealth funding for biofuels research infrastructure during 2010-11 was \$3,560,000 (NCRIS \$1,560,000 and SSI \$2,000,000)

National Collaborative Research Infrastructure Strategy (NCRIS) - September 2007 to June 2012, \$7,980,000

Through NCRIS, the Commonwealth Government and State Government partners have enhanced Australia's capacity to produce biofuels and other products derived from non-food biomass in pre-commercial quantities.

This project has involved the development of five integrated sites located around Australia that aim to provide Australian based researchers with subsidised access to quality facilities, technologically advanced equipment, and technical expertise required for process development and pilot scale manufacture of biofuels and other products from lignocellulosic biomass.

Laboratory infrastructure at three participating universities has been enhanced to facilitate process development activities.

- University of Sydney - Hydrothermal decomposition of biomass
- Macquarie University - Enzyme discovery, enhancement and expression
- University of New South Wales - High productivity fermentation processes

Pilot Scale Manufacture: Two pilot and demonstration scale manufacturing facilities have been established, one for the conversion of cellulosic biomass to ethanol, and the other for the production of biodiesel from microalgae.

- Queensland University of Technology (QUT) Mackay Renewable Biocommodities Pilot Plant Facility: Manufacture of bioethanol and high value biocommodities from cellulosic biomass.
- NCRIS Photobioreactor Facility, South Australian Research and Development Institute (SARDI): Production of biodiesel and high value products from microalgae

\$7.98 million of Commonwealth funding has facilitated the development and utilisation of the facilities across Australia. When State government and host institution contributions are considered the overall biofuels project value is \$15 million (<http://www.ncrisbiofuels.org/>)

The project is being managed by AusBiotech.

Super Science Initiative (SSI) - December 2009 to June 2012, \$1,560,000

Under the SSI \$10 million is provided for the Sustainable Energy project, which has two components to it: fusion and biofuels. Out of \$10 million, \$7 million is provided to the Australian National University for the upgrade of the national plasma fusion facility; and \$3 million is provided to AusBiotech for the second generation biofuels research infrastructure – Biofuels project.

The work under the Biofuels project builds on the results of the biofuels component of the NCRIS project. The SSI \$3 million is invested to further develop and upgrade infrastructure at two biofuels production facilities in Queensland and South Australia (as described above).

Running commercial biorefineries

Table AUS4. Example of the most representative existing biorefineries

Company	Feedstock	Products	Description	Size
Proserpine Sugar	bagasse	furfural	Production of furfural from bagasse	yield of up to 5,000 tonnes per annum

Demo and pilot plants

Table AUS5. Examples of the most representative demo and pilot plants

Company	Feedstock	Products	Description	Status (demo/pilot)
Queensland University of Technology Mackay Renewable Biocommodities Pilot Plant Facility	a range of feedstocks	ethanol and biocommodities	R&D infrastructure for the conversion of cellulosic biomass into renewable transport fuels (bioethanol) and high value biocommodities in an integrated biorefinery. (http://www.ctcb.qut.edu.au/programs/pilot.jsp)	pilot scale R&D
South Australian Research and Development Institute's Photobioreactor Facility	microalgae	biodiesel	Photobioreactor for the production of biodiesel from microalgae. (http://www.sardi.sa.gov.au/aquaculture/aquaculture/ncris_photobioreactor_facility)	pilot scale R&D
Curtin University of Technology – Perth Western Australia	Mallee biomass	Bio-crude	This is a project that has been partially funded by the Australian Government Second Generation Biofuels Research and Development (Gen 2) Program	Demonstration
Licella – Ignite Energy	Forestry industry waste wood materials	Bio-crude	This is a project that has been partially funded by the Australian Government Second Generation Biofuels Research and Development (Gen 2) Program	Pilot plant exists – a commercial demonstration plant is being built
Microbiogen	Lignocellulosic bagasse from sugar cane production	Bio-ethanol	This is a project that has been partially funded by the Australian Government Second Generation Biofuels Research and Development (Gen 2) Program	Pilot plant
MBD Energy	microalgae	nutraceutical, pharmaceutical, aquaculture and renewable energy	This project is being progressed in partnership with the Advanced Manufacturing Cooperative Research Centre, Tarong Power Station and James Cook University	Commercial demonstration plant

Murdoch University Western Australia	algae	nutraceutical, pharmaceutical, aquaculture and renewable energy	Partners are University of Adelaide, Parry Nutraceuticals (India) and South China Institute of Technology	Demonstration
Aurora Energy	algae	nutraceutical, pharmaceutical, aquaculture and renewable energy	Privately owned US company with some Australian Government funding support. Based in Karratha Western Australia	Commercial demonstration
Algae Tec	algae	nutraceutical, pharmaceutical, aquaculture and renewable energy	Commercial partnership with Manildra, Nowra NSW	Commercial demonstration

Major RTD activities

Second Generation Biofuels Research and Development (Gen 2) Program

The Gen 2 Program was designed to encourage research, development and demonstration of next generation (non-food based) biofuel technologies that have the potential to enhance Australia's liquid transport fuel security and greenhouse gas reduction. On 5 August 2009, the Minister for Resources and Energy announced the seven successful applicants under the Gen 2 Program at Curtin University of Technology, Western Australia. The suite of projects encompasses a broad range of second generation biofuel technologies and feedstocks including the use of microalgae, sugarcane biomass and sugarcane bagasse, forestry waste and Mallee biomass. Six agreements were executed, with \$12,617,000 (GST ex) committed over the three year period to 30 June 2012.

Australian Biofuels Research Institute

The new Australian Biofuels Research Institute (ABRI) will support, through a merit based selection process, the demonstration and commercialisation of next generation biofuels (i.e. those not derived from food feedstocks such as corn or sugar cane) based on technologies being developed both internationally and in Australia. An ABRI Establishment Council, consisting of prominent persons from the biofuels research community, industry and government has been appointed by Minister Ferguson to advise on a number of issues, including guidance on the conduct of the next generation Biofuels Economics Study (BES) that will inform the priorities of ABRI; a timeline and work plan to achieve the establishment of ABRI; the scope and work plan of a \$5 million next generation biofuels foundation grant for James Cook University (JCU); the terms of reference of an ABRI Advisory Council; and the broad scope of the ABRI funding strategy. The BES will focus on identifying the latest international and Australian developments in next generation biofuels technologies, assessing their economic potential and prioritising those technologies in terms of their commercial potential and compatibility with Australian conditions (e.g. types of feedstock and availability of arable land, high levels of sunshine and potable water supply). Next generation biofuels are derived from non-food and non-traditional feedstocks such as algae, lignocellulose, and oil seeds and are not expected to compete with food production

Stakeholders

Table AUS6. Major stakeholders in Australia

Name	Short Description
Industry	
Biofuels Association of Australia (BAA)	Industry Association of key biofuel players
Bioenergy Australia	Networking
Research Institutes	
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Various bioenergy, biomass and biofuel related research activities
South Australia Research and Development Institute (SARDI)	Various research projects including algae development
Universities	
James Cook University, Townsville, QLD	Algae research and pilot project
Murdoch University, Perth, WA	Algae research and development
Monash University	Materials, gasification, green chemistry
Curtin University	Bioenergy R&D
University of Melbourne	Algae research
Flinders University Adelaide	Algae research
University of Queensland	Algal biofuels research
Various other universities	Various bioenergy related projects
Governmental Organisations	
Department of Resources, Energy and Tourism	Biofuels and bioenergy policy and programs
Department of Agriculture, Fisheries and Forestry	Agricultural and forestry policy
Department of Climate Change and Energy Efficiency	Office of the Renewable Energy Regulator
Department of Innovation, Industry, Science and Research	Policies and programs to support R&D and development of a national innovation system including industrial biotechnologies. Pulp and Paper Industry Innovation Council.
Non-governmental Organisations (NGOs)	

Other issues/updates

In 2010, the Australian Government commissioned two research scoping studies to identify the opportunity for Australian biomass based value chains using tropical and temperate feedstocks. The studies investigated the technical and financial feasibility of developing integrated biorefineries in Australia to produce fuels, heat, chemicals and other industrial products from biomass rather than fossil fuels.

The studies found a number of benefits for Australia in developing biomass value chains including: the potential for substantial export revenues, regional development, opportunities to revitalise industries, and climate change mitigation.

The studies also reported that there is a growing international market for biobased chemicals and fuels, and that there is sufficient temperate and tropical biomass available in Australia for commercial production. The tropical sugarcane industry is well positioned for such diversification, while closer region-specific analysis will be required for temperate crops and forestry. Co-production of higher-value chemicals along with fuels will be crucial for commercial viability.

The studies are expected to inform several government activities including the review of the National Industrial Biotechnology Strategy to include the consideration of using local biomass to produce industrial chemicals and other products in biorefineries.