



IEA Bioenergy
Technology Collaboration Programme



Country Report Australia

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Technology Collaboration Programme

by **iea**

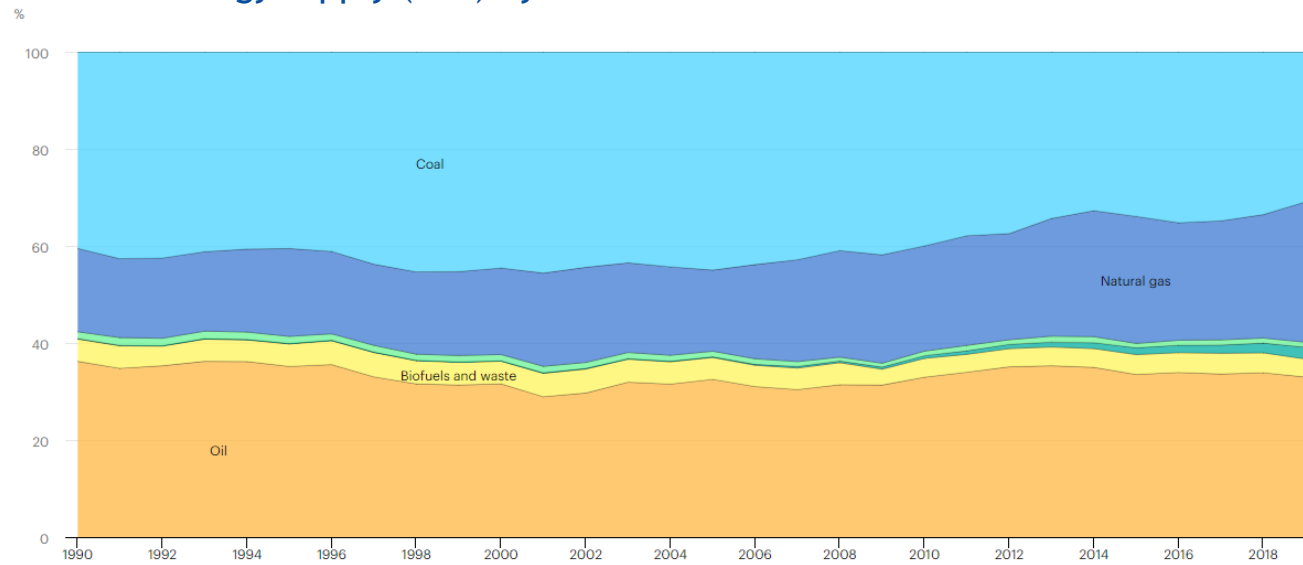
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1. Total primary energy supply and contribution of bioenergy: current status

Total primary energy supply and contribution of bioenergy: current status

Total energy supply (TES) by source. Australia 1990-2019



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● Coal ● Natural gas ● Hydro ● Wind, solar, etc. ● Biofuels and waste ● Oil

Total energy supply - 2019

YEAR	Coal	Natural gas	Hydro	Wind, solar, etc.	Biofuels and waste	Oil	Units
2019	40909	38331	1350	3213	4941	43687	ktoe

Total primary energy supply and contribution of bioenergy: current status

Australian electricity generation by fuel type

	2018–19		Average annual growth	
	GWh	share (per cent)	2018–19 (per cent)	10 years (per cent)
Fossil fuels	212,003	80.3	-2.0	-0.9
Black coal	119,845	45.4	-1.5	-0.4
Brown coal	34,460	13.1	-4.3	-5.3
Gas	52,775	20.0	-2.1	1.9
Oil	4,923	1.9	2.1	5.2
Renewables	52,024	19.7	16.5	10.1
Hydro	15,967	6.0	-0.3	1.8
Wind	17,712	6.7	16.7	15.0
Bioenergy	3,496	1.3	-0.6	2.6
- bagasse	1,287	0.5	-9.7	na
- wood, woodwaste	398	0.2	26.5	na
- municipal, industrial waste	60	0.0	-36.6	na
- sulphite lyes, biofuels	418	0.2	-2.6	na
- landfill biogas	1,084	0.4	5.6	na
- sludge biogas	248	0.1	9.7	na
Solar PV	14,849	5.6	49.5	48.4
- small scale	11,116	4.2	24.6	43.7
- large scale	3,732	1.4	270.4	na
Total	264,027	100.0	1.1	0.5

na – not available

Source: Department of Industry, Science, Energy and Resources (2020) *Australian Energy Statistics*, Table O

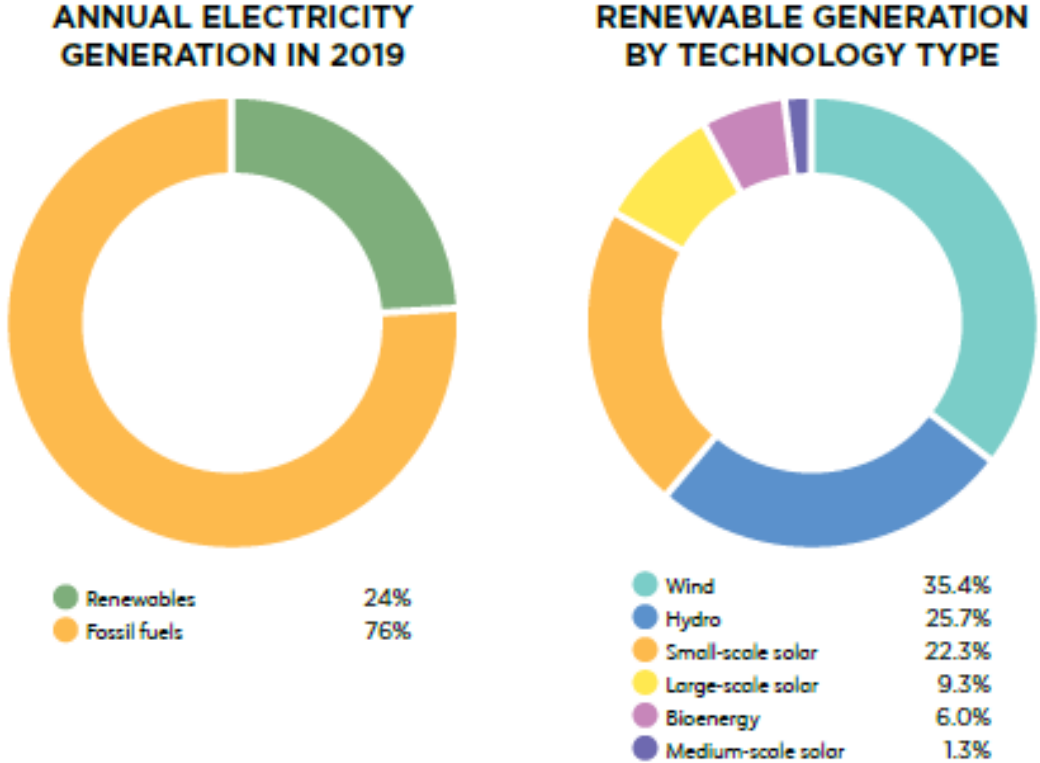
2. Renewable energy generation

Renewable energy generation

RENEWABLE ENERGY GENERATION ¹				
TECHNOLOGY	GENERATION (GWh)	PERCENTAGE OF RENEWABLE GENERATION	PERCENTAGE OF TOTAL GENERATION	EQUIVALENT NUMBER OF HOUSEHOLDS POWERED OVER COURSE OF THE YEAR
Wind	22,605	35.9%	9.9%	4,918,363
Small-scale solar PV	14,807	23.5%	6.5%	3,221,737
Hydro	14,638	23.3%	6.4%	3,184,968
Large-scale solar PV	6835	10.9%	3.0%	1,487,155
Bioenergy	3164	5.0%	1.4%	688,427
Medium-scale solar PV	868	1.4%	0.4%	188,910
TOTAL	62,917	100.0%	27.7%	13,689,560

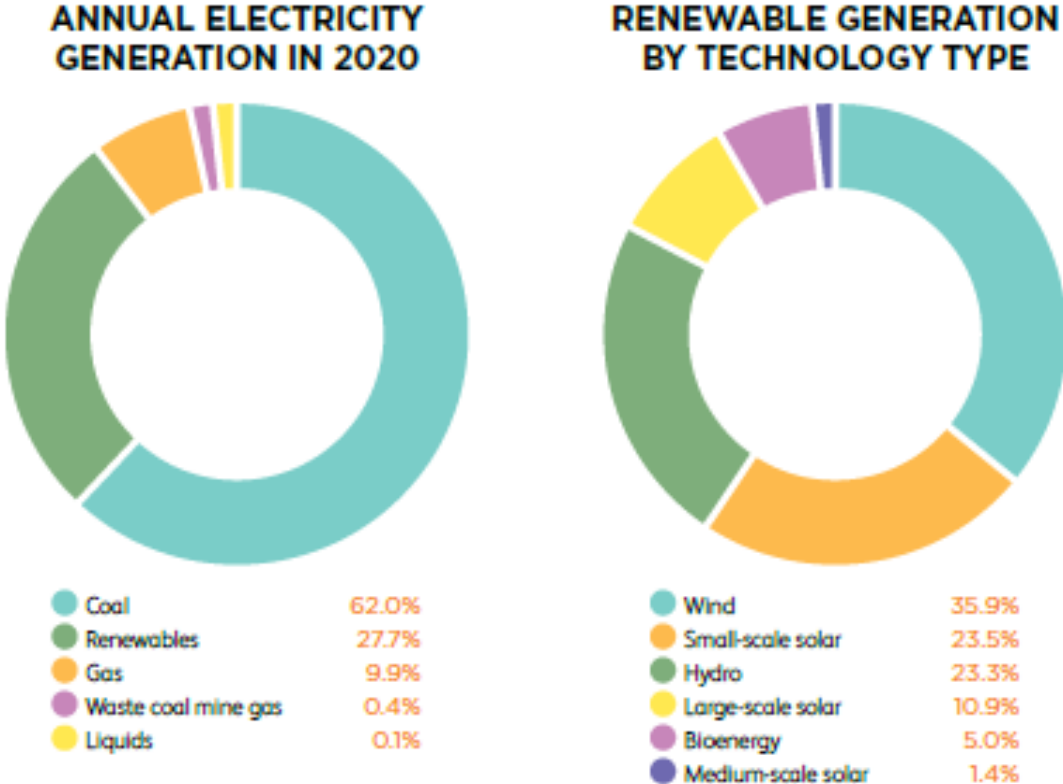
<https://www.iea.org/countries/australia>

Renewable energy generation - 2019



<https://assets.cleanenergycouncil.org.au/documents/resources/reports/clean-energy-australia/clean-energy-australia-report-2021.pdf>

Renewable energy generation - 2020



<https://assets.cleanenergycouncil.org.au/documents/resources/reports/clean-energy-australia/clean-energy-australia-report-2021.pdf>

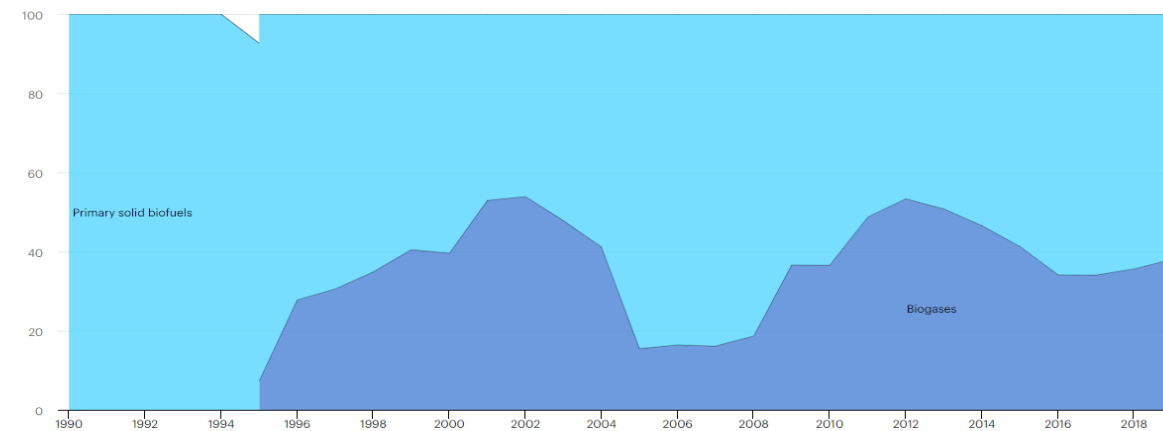
3. Contribution of bioenergy

Contribution of bioenergy



<https://assets.cleanenergycouncil.org.au/documents/resources/reports/clean-energy-australia/clean-energy-australia-report-2021.pdf>

Electricity generation from biofuels and waste by source. Australia 1990-2019

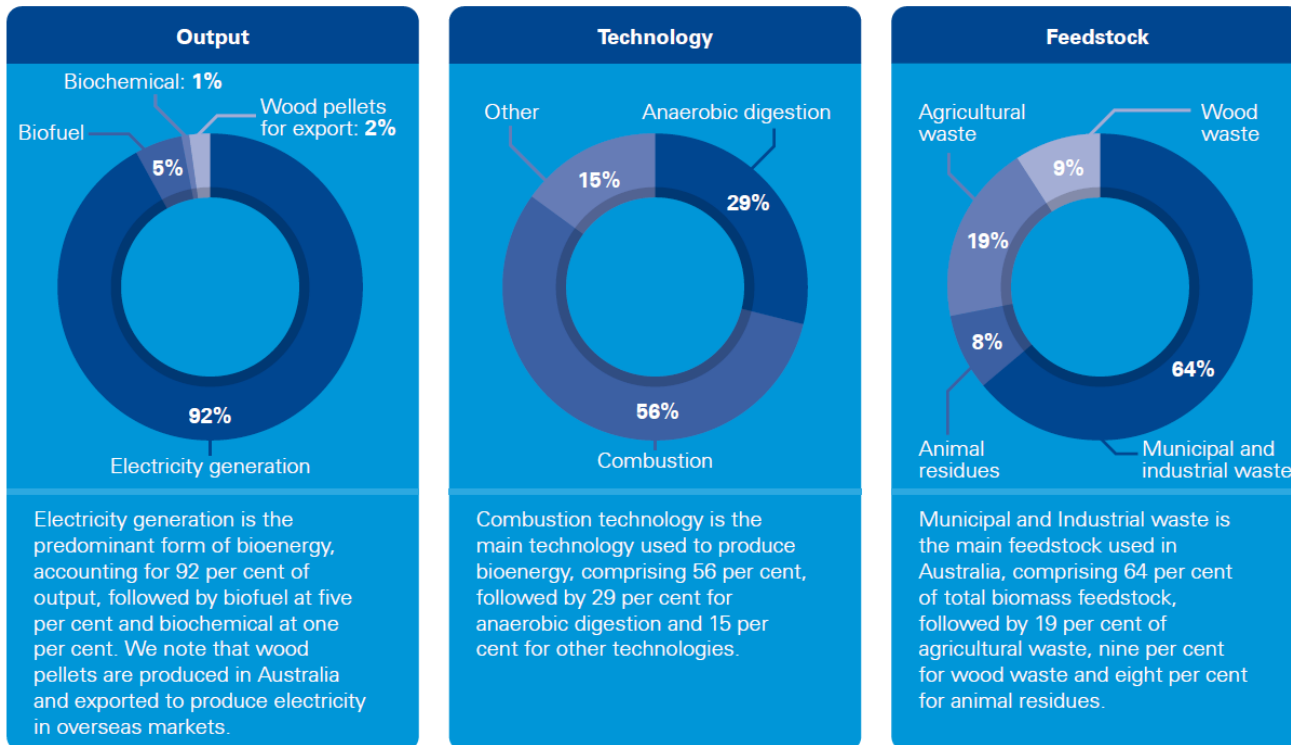


YEAR	Primary solid biofuels	Biogases
2019	2168	1332

<https://www.iea.org/data-and-statistics?country=AUSTRALI&fuel=Energy%20sapply&indicator=WasteGenBySource>

Contribution of bioenergy

Commissioned projects by technology, feedstock and end use: 2018



<https://cdn.revolutionise.com.au/news/vabsvwo5pa8jnsngs.pdf>

4. Bioenergy policies

Australian emissions trends and targets

Current Government policies are targeting a 26% to 28% CO2 reduction below 2005 by 2030

Reduction is to be driven through various mechanisms

- A\$2 billion Climate Solutions Fund

- Snowy 2.0 pumped hydro

- A second power from Tasmanian

- National Electric Vehicle Strategy

- Improve energy efficiency

Bioenergy Roadmap under development - delivery is expected soon

- The Australian Federal Government is developing a Bioenergy Roadmap through ARENA

- The Roadmap will help inform the next series of investment and policy decisions for bioenergy in Australia

5. Commercial biorefineries

Manildra - Nowra

Location: Nowra, New South Wales

Type/Size: Biochemical conversion of starch sugars to ethanol

Capacity: Approximately 300ML per year

Other: Largest facility of its kind in South East Asia
Range of products including a range of grades for food and beverages, pharmaceuticals and personal care.

Extensive ethanol grades for domestic and international markets



Sarina - Mackay

Location: Mackay, Queensland

Type/Size: Biochemical conversion of molasses to ethanol

Capacity: Approximately 60ML per year

Other: Only facility in Australia based on sugar cane molasses

A by-product of the process is a liquid fertiliser called Bio Dunder and Liquid One Shot

Plant commenced production in 1927 and utilises approximately 220,000 tonnes of molasses each year.

About 70% of the ethanol is sold into the fuel market



Ecotech Biodiesel - Brisbane

Location: Brisbane, Queensland

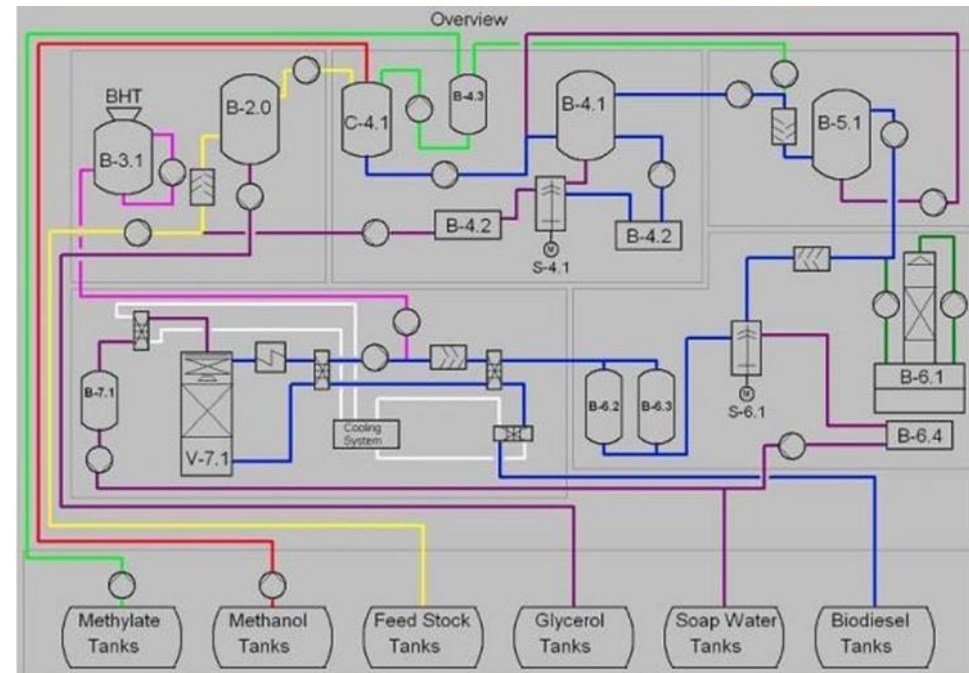
Type/Size: Two stage base catalysed esterification process

Capacity: Approximately 30ML per year

Other: A two stage quasi continuous process allows for quality control at each stage of production

Technology has been licensed from Germany

Produce is sold into the Australia fuel market and is generally available in a B5 format



Barnawartha Biodiesel - Victoria

Location: Near Wodonga, Victoria

Type/Size: Biodiesel produced using a batch process

Capacity: Approximately 60ML per year

Other: Operations commenced in September 2017
Currently in operation at reduced capacity

Most product is exported to the EU and California

Substrate utilised is typically tallow and used cooking oils



6. Demo and Pilot plants

Licella - Somersby CAT-HTR

Location: Somersby, New South Wales

Type/Size: Biocrude from renewable sources

Large pilot scale operation

Other: Over A\$75M spent to develop the technology to date

Technology utilises a unique Catalytic Hydrothermal Reactor ready for commercialisation

Substrate utilised include non-edible biomass, end-of-life plastic and used lubrication oils amongst others

Products: Stable biocrude or synthetic crude oil



Northern Oil Advanced Biofuels Pilot Plant

Location: Yarwun, near Gladstone, Queensland

Type/Size: Biofuels (biocrude) from biomass
Pilot scale operation

Other: The pilot plant is located adjacent to the Northern Oil Refinery

The pilot plant was commissioned in 2017 and can convert biomass such as sugar cane bagasse and prickly acacia

Based on the results from the pilot plant, a much larger A\$150 million facility is planned with a capacity of 200 million litres per year

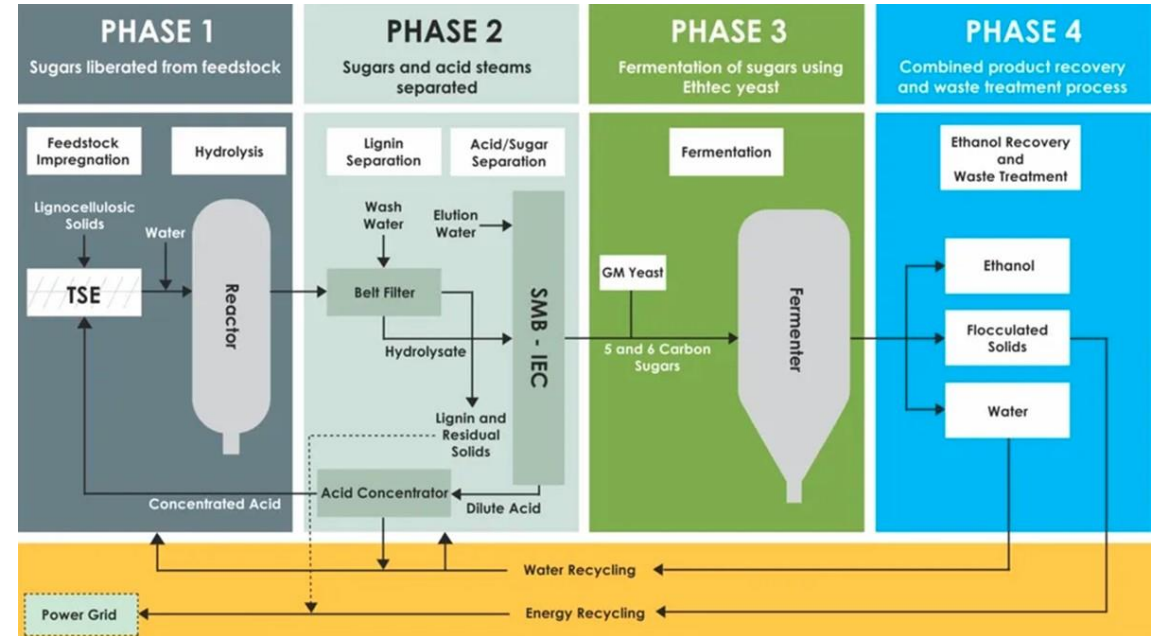


Ethtec Pilot Plant

Location: Muswellbrook, New South Wales

Type/Size: Hunter Pilot Biorefinery (HPB) - Biochemical
Pilot scale operation

Other: Multistage biorefinery pilot plant. Uses concentrates sulphuric acid and a twin screw extruder
After dilution with water, the sugars are liberated under temperature and pressure
Lignin is used as fuel and the acid recovered and recycle. GM yeast used to convert sugar monomers into ethanol or other high value products



7. R+D Initiatives and success story

ARENA - Background



Australian Government
Australian Renewable
Energy Agency

ARENA

Background: The Australian Renewable Energy Agency (ARENA) supports projects that advance renewable energy technologies along the innovation chain: from early stage research in the lab, to later stage demonstration projects in the field.

Projects: Projects funded by ARENA: 579

Funds invested: Total funds invested: A\$1.67B (US\$1.28B)

ARENA - Current Programs



Australian Government
Australian Renewable
Energy Agency

ARENA

Advancing Renewables Program:

Development, demonstration and pre-commercial deployment projects

Industrial Energy.
Transformational Studies Program:

In October 2020, the Australian Government announced \$2.47 billion in funding for measures that aim to lower energy prices, reduce emissions and boost the economy.

Innovation Fund:

Emerging Australian technologies & businesses that can accelerate Australia's transition to a renewable energy economy.

ARENA - Investment Priorities



Australian Government
Australian Renewable
Energy Agency

ARENA

Priority 1.

Integrating renewables into the electricity system:

By investing in innovative ways to use, store, manage and share renewable energy, ARENA can help provide affordable, secure and reliable electricity for Australians through the energy transition

Priority 2.

Accelerating hydrogen:

ARENA will help drive innovation in hydrogen supply chains, from production to end use, creating opportunities across the domestic economy, and positioning Australia to become a major renewable energy exporter.

Priority 3.

Supporting industry to reduce emissions:

ARENA will help Australian industry reduce emissions by investing in innovative and replicable technologies and processes that increase the adoption of renewable energy (including renewable electricity, renewable fuels, solar thermal, hydrogen and bioenergy).

ARENA - Bioenergy Success Story...



Australian Government
Australian Renewable
Energy Agency

ARENA

Advancing Renewables

Total project: A\$8M (US\$6.2M)
3.5 year project

Key Outcomes.

Benchmarked against current
commercial Gen II yeast biocatalyst



MICROBIOGEN

“Biocatalyst optimisation for efficient production of biofuels from non-food biomass and deployment through a global partner corporation”

A Game Changer for Biofuels

- An estimated 25% effective reduction in operating costs
- High value single-cell protein as a by-product from non-food biomass
- The more biofuels manufactured - the more high-value protein produced
- If Australia converted just its sugar cane bagasse using the MicroBioGen optimised organism and process, then enough ethanol would be produced to replace nearly 10% of petrol and replace nearly 140,000 tonnes of currently imported protein feed
- Peer reviewed Life Cycle Analysis shows compared to commercial Gen II biocatalyst an additional:
 - 29% reduction in CO₂
 - 11% decline in fossil energy use
 - 240% decrease in land use – compared to the commercial yeast biocatalyst.

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www.ieabioenergy.com