

## Country Reports

IEA Bioenergy: 10 2021



This report was prepared from the 2021 IEA World Energy Balances and Renewables Information, combined with data and information provided by the IEA Bioenergy Executive Committee and Task members<sup>1</sup>. Reference is also made to FAOstat and data from national statistics. All individual country reports were reviewed by the national delegates to the IEA Bioenergy Executive Committee, who have approved the content. General background on the approach and definitions can be found in the central introductory report for all country reports.

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## HIGHLIGHTS

- Oil, coal and gas are still largely dominating in the Australian energy mix. Renewables make up 7% of *total energy supply* in 2019. The renewable energy share in *final energy consumption* is 11%<sup>2</sup>. Around half of renewable energy is from biomass; most bioenergy is applied for industrial heat.
- Australia is a large country with low population density. The use of biomass/bioenergy is very small in relation to its domestic potential. A lot of progress is still possible to deploy bioenergy through solid biomass, liquid biofuels, biogas and energy from MSW.
- Electricity production in Australia is still dominated by coal (60%) and gas (20%). The role of wind and solar power is growing. Bio-electricity has a very modest role.
- The uptake of biofuels in transport is very low (<0.5%), while the use of fossil fuels (particularly diesel) continues to grow. Biofuel mandates exist in two of the eight States and Territories but are not enforced.
- The imminent release of a national Bioenergy Roadmap by the Commonwealth Government is a critical achievement for the industry. The Roadmap clearly identifies the role that the bioenergy

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<sup>1</sup> While data for 2020 are starting to become available at national level, it was decided to consider trends up to 2019 for good comparability and benchmarking between the different IEA Bioenergy member countries. Care should also be taken when using 2020 data for analysing trends as these data are distorted by the COVID19 Pandemic.

<sup>2</sup> The difference between the share of renewables in supply and consumption relates to unused heat from power plants (which is counted in energy supply, but not in final consumption).

sector can play in accelerating Australia’s clean energy transition.

## COUNTRY PROFILE

### Population and land use

Australia has a total land area of 7.69 million km<sup>2</sup> and a very low average population density of 3 persons per km<sup>2</sup>. Its population of 25 million is largely concentrated on the eastern coastline. Australia has a wide variety of landscapes and climates, with deserts in the centre, tropical rainforests in the north-east, and mountain ranges in the south-east. 18% of the Australian mainland is desert, and a large area (>40%) is permanent pastures and rangelands, with little rainfall.

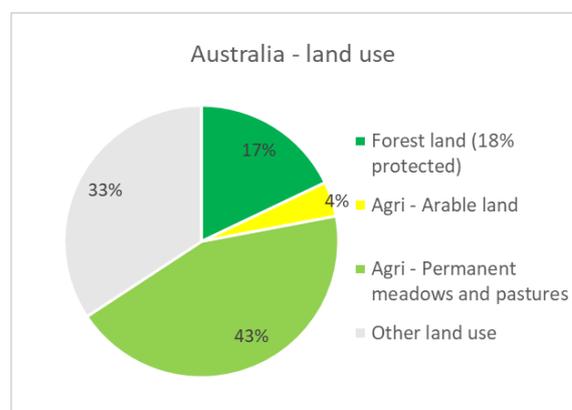


Figure 1: Land use in Australia (source: FAOSTAT)

### Final energy consumption

Overall final energy consumption in Australia (also including non-energy use of oil, natural gas, and coal in industry) equates 3.3 tonnes of oil equivalent (toe) per capita, which is relatively high compared to the other member countries of IEA Bioenergy. Particularly energy use in transport is very high (almost double compared to the average of IEA Bioenergy member countries), which to some extent can be explained by the long distances within the country but is also due to there being no incentives for fuel-efficient vehicles and fuel being some of the cheapest in the OECD. Residential energy use is on the low side, which is likely related to the warm climate conditions in most of the country (less domestic heating requirements).

Table 1: Distribution of the final consumption of energy carriers by sector in Australia (2019 figures - Source: IEA (2021) World Energy Balances and Renewables Information)

Final consumption energy carriers	Toe/capita (2019)	% of total	Median* (toe/capita)
Industry (energy use)	0.88	27%	0.67
Industry (non-energy use)	0.21	6%	0.21
Transport	1.34	41%	0.69
Residential	0.42	13%	0.57
Commercial & public services	0.32	10%	0.34
other	0.09	3%	0.07
<b>Total</b>	<b>3.27</b>		<b>2.34</b>

\* Median of the 25 member countries of IEA Bioenergy<sup>3</sup>

<sup>3</sup> Comparative figures of the different IEA Bioenergy member countries are discussed in the central Countries’ Report.

# NATIONAL POLICY FRAMEWORK IN AUSTRALIA

## TARGETS AND STRATEGIES

Australia contributes to global efforts to address climate change, meeting its emissions reduction targets while maintaining economic growth. Australia's 2030 target under the Paris Agreement to reduce emissions by 26 to 28% below 2005 levels amounts to a halving of per-person emissions and almost a two-thirds reduction in emissions intensity of economic activity. In addition, every state and mainland territory government in the country has made either aspirational or legislated commitments toward net zero-emissions. As an example, Victoria has legislated a net zero emissions by 2050 target, and the ACT has legislated a target to be net zero by 2045.

The Large-scale Renewable Energy Target of 33,000 gigawatt hours (GWh) was achieved in 2019 and on a rolling 12-month basis, at the end of January 2021. Eligible generation from 1 February 2020 to 31 January 2021 reached an estimated 33,100 GWh. The 33,000 GWh target remains the Federal Government's only mandated target and remains at this level until 2030 despite having been reduced from 41,000 (GWh) in 2010. Despite being called the Renewable Energy Target it only covers electricity.

The Federal Government is developing Australia's Long-term Emissions Reduction Strategy, which will be presented at the 26th United Nations Framework Convention on Climate Change (UNFCCC) climate summit in Glasgow in 2021.

As part of this strategy, in September 2020, the government released its Technology Investment Roadmap, which will accelerate development and commercialisation of new and emerging low emissions technologies.

Looking specifically at the bioenergy industry, the development of Australia's first Commonwealth Bioenergy Roadmap represents a significant achievement for the sector. The Roadmap will be an important input into the Australian Government's Technology Investment Roadmap with significant opportunities in terms of energy security and emissions reduction.

*Table 2: Renewable energy and climate targets in Australia*

Sector	Share of renewables in gross final consumption per sector	GHG reduction target
<b>Overall target</b>		-26 to 28% by 2030 compared to 2005 levels Net zero carbon by 2050
<b>Heating and cooling</b>	None	None
<b>Electricity</b>	33 TWh in 2020 (~12%) 50% by 2030	None
<b>Transport</b>	None	None

In terms of funding and incentives for the broad renewable energy sector, the Government has committed \$3.5 billion through the Climate Solutions Package to deliver on Australia's 2030 Paris Agreement obligations, building on existing climate change mitigation policies and programs.

The key mechanism to support emissions reduction in Australia is the Emissions Reduction Fund (ERF), which incentivises Australian businesses to reduce greenhouse gas emissions and to undertake activities that store carbon. Participants can earn Australian Carbon Credit Units (ACCUs) for every tonne of emissions reduced or stored through a project. Businesses can sell ACCUs to generate income, to the Australian government through an auction, and/or to other businesses.

The Minister for Energy and Emissions Reduction, supported by the Department of Industry, Science, Energy and Resources sets the priorities for the development of new ERF methods. Bioenergy, in its different forms, is incorporated in some of these methods and a new biomethane ERF method is currently under development to support the emerging biomethane industry and meet the Federal Government's commitment to reduce carbon emissions.

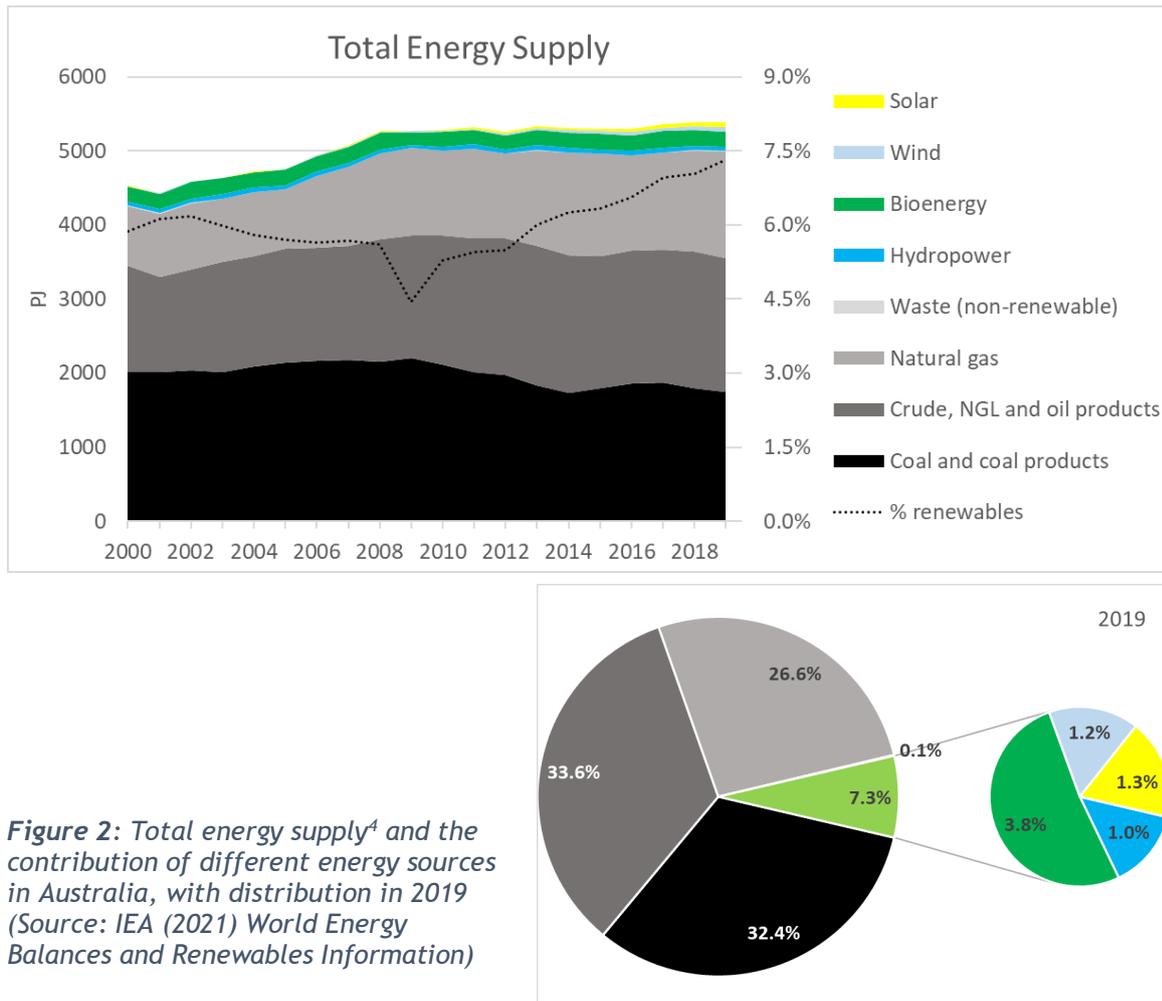
A description of renewable energy and climate policies and measures in Australia is available at the IEA's Policies and Measures Database: <https://www.iea.org/policies?country=Australia>

Specific policies related to renewable electricity, renewable heat and transport biofuels will be highlighted in the chapters about the role of bioenergy in different sectors.

# THE CONTRIBUTION OF BIOENERGY IN NATIONAL ENERGY SUPPLY

## TOTAL ENERGY SUPPLY

The total energy supply (TES) of Australia in 2019 amounted to 5,390 petajoule (PJ) with fossil fuels (oil, coal, gas) still contributing more than 90%. Oil products (1813 PJ) and coal products (1744 PJ) each represent around a third, and natural gas (1435 PJ) around a quarter. Renewable energy sources (394 PJ) represent 7% of total energy supply. Around half of renewable energy supply in 2019 comes from biomass (203 PJ), followed by solar energy (71 PJ), wind energy (64 PJ) and hydropower (57 PJ).



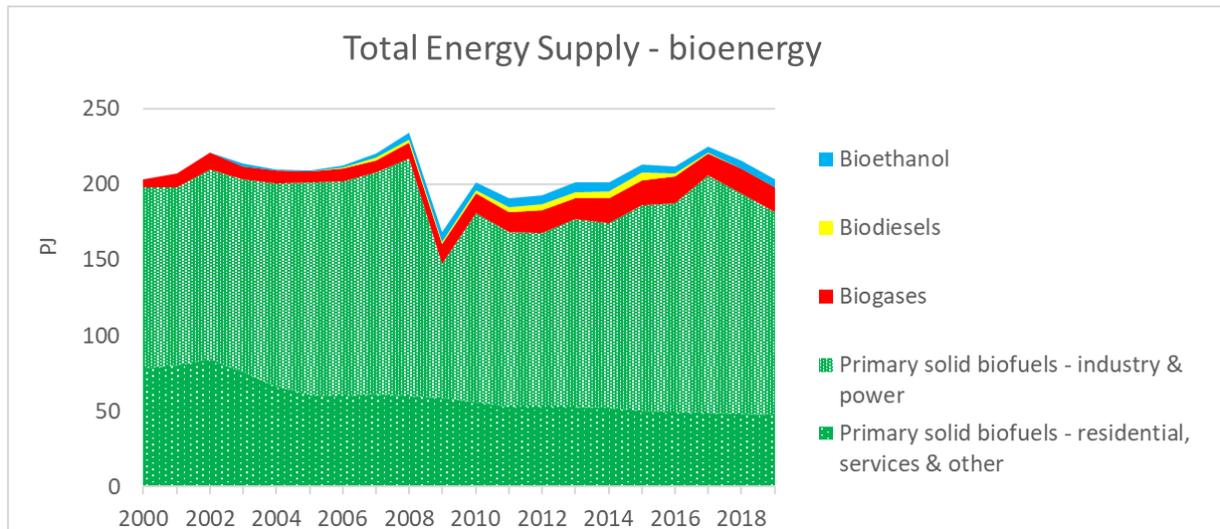
**Figure 2:** Total energy supply<sup>4</sup> and the contribution of different energy sources in Australia, with distribution in 2019 (Source: IEA (2021) World Energy Balances and Renewables Information)

Total energy supply was very stable in the past 10 years. There was a reduction of the role of coal between 2009 and 2013 from 2200 PJ (43% of TES) to 1800 PJ (34% of TES) with stabilisation around that level after 2013. Oil has been quite stable around 1800 PJ (~34% of TES) in the past 10 years, while natural gas saw a steady increase since 2010 from 1200 PJ (22% of TES) to 1400 PJ (27% of TES).

<sup>4</sup> Total energy supply refers to the use of resources. In terms of the role in the energy system this distribution overestimates the role of resources producing electricity with a high share of unused waste heat (like nuclear plants).

Renewable energy increased in the past 10 years from 5.3% to 7.3% of total energy supply. The overall share of bioenergy in total energy supply was rather stable around 4% of TES in the past decade, while solar and wind combined increased from 0.5% to 2.5%. Hydropower was stable around 1%.

As shown in Figure 3, the total amount of bioenergy fluctuates around 200 PJ, with a slight growing tendency since 2010, although this seems to have reversed somewhat from 2017. Solid biofuels represent the major part (90%) of bioenergy in Australia. The figure below shows that most of that amount is used in industry for power production. The other bioenergy types are biogas (7.5%) and bioethanol (2.3%).



**Figure 3:** Development of total energy supply from bioenergy in Australia 2000 - 2019 (Source: IEA (2021) World Energy Balances and Renewables Information)

Evolution of the bioenergy carriers:

- Main growth of solid biomass was in industry, although this seems to reverse somewhat since 2017. The use of solid biomass for residential heating is slightly decreasing over the years.
- Biogas had a steady increase since 2000 and stabilized around 16-17 PJ in the past 5 years.
- Biodiesel increased up to 5 PJ in 2015 but dropped back to zero in recent years.
- Bioethanol has fluctuated between 4 and 6 PJ since 2008.

Table 3 displays the 2019 total bioenergy supply values on a per capita basis. Compared to the other 24 member countries of IEA Bioenergy (expressed per capita), Australia ranks in the middle for solid biofuels and biogas, and very low for liquid biofuels and renewable MSW, so a lot of progress can be made for the latter.

*Table 3: Total energy supply per capita in 2019 for different bioenergy carriers*

	Supply per capita	Median IEA Bioenergy members
<b>Bioenergy</b>	8.1 GJ/cap	10.6
<b>Solid biofuels</b>	7.2 GJ/cap	7.0
<b>Renewable MSW</b>	0.0 GJ/cap	0.8
<b>Biogas</b>	0.6 GJ/cap	0.7
<b>Liquid biofuels</b>	0.2 GJ/cap	1.5

Source: IEA (2021) World Energy Balances and Renewables Information

Table 4 indicates the amounts of the different bioenergy carriers compared to some relevant reference points, namely the amount of forest in the country (for solid biomass), the amount of generated MSW (for renewable MSW used for energy), the amount of natural gas consumed in the country (for biogas) and the amount of fossil oil products consumed (for liquid biofuels).

*Table 4: Comparison of the supply of different bioenergy carriers in 2019 to specific reference points*

	Compared to reference points		Median*
<b>Bioenergy</b>	3.8 %	of total energy supply	7.2 %
<b>Solid biofuels</b>	1.7 GJ/ha_forest	compared to the domestic hectares of forest land (excl. protected)	21.3 GJ/ha_forest
<b>Renewable MSW</b>	0.00 GJ/ton_MS_W	compared to the total generated MSW in the country	1.4 GJ/ton_MS_W
<b>Biogas</b>	0.011 GJ/GJ_NG	compared to natural gas supply	0.023 GJ/GJ_NG
<b>Liquid biofuels</b>	0.003 GJ/GJ_oil	compared to oil products supply	0.028 GJ/GJ_oil

Source: energy data from IEA (2021) World Energy Balances and Renewables Information; forest figures from FAOStat; waste figures from World Bank  
\* median of the 25 member countries of IEA Bioenergy<sup>5</sup>

Specific comments in relation to the reference points:

- The use of solid biomass for energy is very low compared to the amount of forest land in Australia (less than 0.1 tons\_dry mass of wood per hectare<sup>6</sup>).
- Energy production from (the renewable share of) MSW is just beginning to be developed with two Waste to Energy plants under construction in West Australia and other states looking at similar projects. In parallel the various states are also looking to separate the organic fraction of municipal solid waste (OFMSW), such as food and garden organics (FOGO) for use in anaerobic digestion or composting. There are good opportunities for mobilization in this area but the number of processing facilities for FOGO needs to increase.

<sup>5</sup> Comparative figures of the different IEA Bioenergy member countries are discussed in the central Countries' Report.

<sup>6</sup> Counted with a typical calorific value of wood (dry mass) of 19 GJ/ton\_dry mass

## ROLE OF BIOENERGY IN DIFFERENT SECTORS

### OVERVIEW

The overall share of renewables in **final energy consumption** among electricity, transportation and heat sectors is a little over 10%, with bioenergy making up 5% of the energy share (Table 5). Mind that these figures are higher than the shares in total energy supply (where unused waste heat, e.g., in power production, is also included).

*Table 5: Role of bioenergy and renewable energy in electricity, transport energy and fuel/heat consumption as well as final energy consumption in 2019*

Sector	Share of bioenergy	Share of renewable energy	Overall consumption
Electricity <sup>7</sup>	1.3%	19.6%	264 TWh (949 PJ)
Transport energy (final consumption)	0.4%	0.7%	1417 PJ
Overall fuel and heat consumption <sup>8</sup>	14.9%	16.4%	1058 PJ
<b>TOTAL FINAL ENERGY CONSUMPTION</b>	<b>5.0%</b>	<b>10.6%</b>	<b>3402 PJ</b>

*Source: IEA (2021) World Energy Balances and Renewables Information*

The following paragraphs will consider the evolutions in the different sectors.

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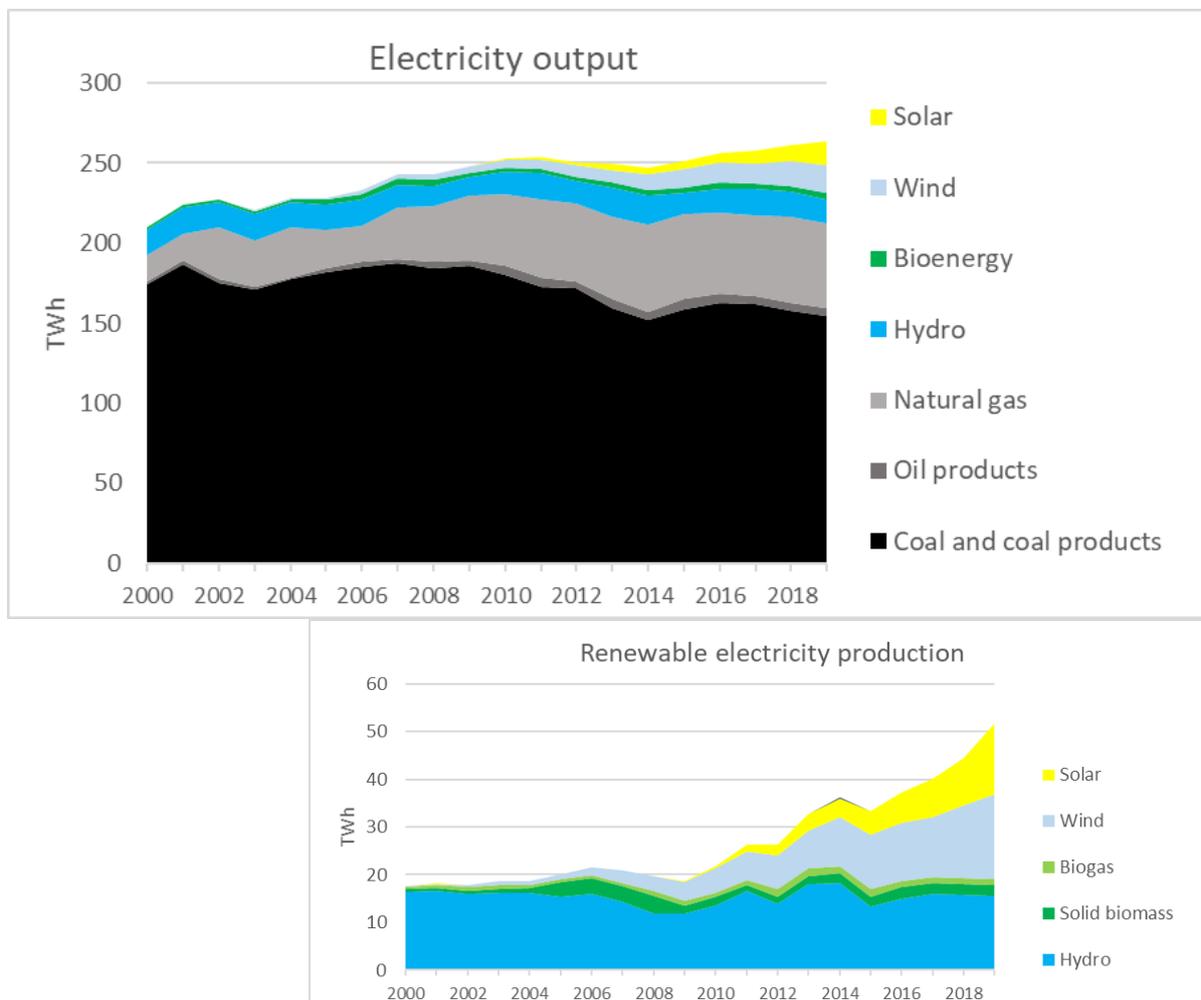
<sup>7</sup> Renewable electricity production compared to final consumption. Potential renewable shares of imported electricity are not included.

<sup>8</sup> This includes final consumption of fuels and heat in industry, the residential sector, commercial and public services and agriculture/forestry. Transport fuels are excluded. Energy used for transformation and for own use of energy producing industries is also excluded.

Electric heating (direct or through heat pumps) is not included in these figures as this is not separately reported.

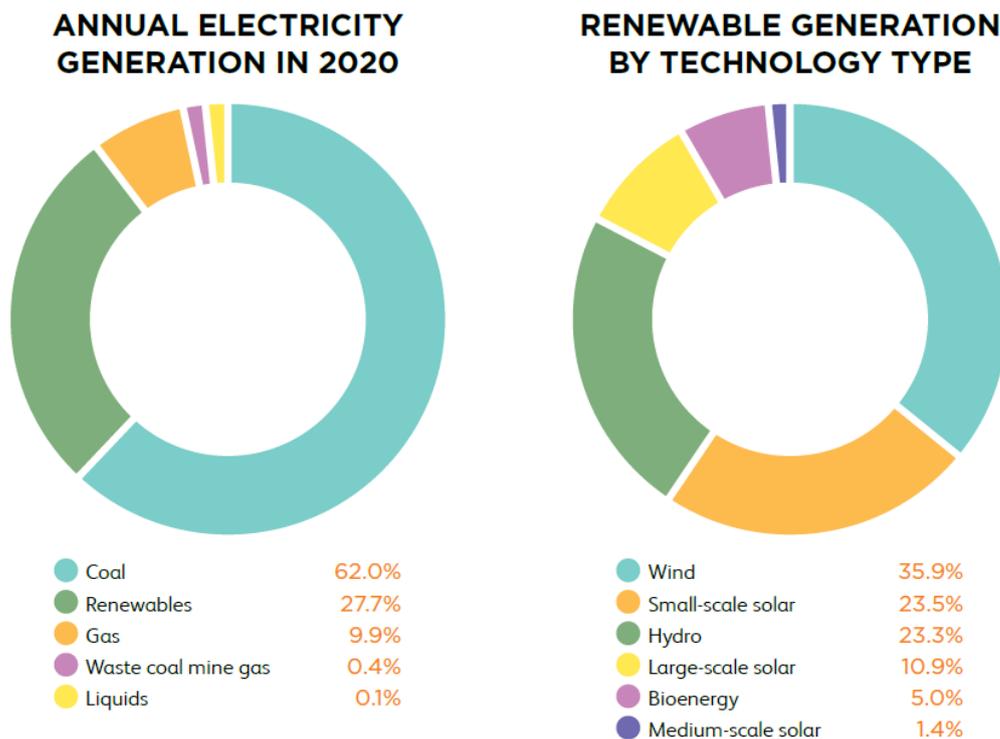
## ELECTRICITY

The Australian power production is still largely dependent on coal (60%) and gas (20%). The use of coal is going down slightly, while gas is fairly stable. Renewable electricity was initially mostly based on hydropower; in the past decade wind and particularly solar power had a strong increase and both came to a similar level as hydropower in 2019 (around 6% of power production). Biomass-based electricity only plays a modest role (1.3%).



**Figure 4: Evolution of the electricity mix in Australia 2000 - 2019 (Source: IEA (2021) World Energy Balances and Renewables Information)**

The following figure shows new figures for 2020 from Australian statistics. There was further growth in renewables up to a level of 27.7% of electricity generation, with main growth in wind and solar.



*Figure 5: Distribution of electricity generation in Australia in 2020. Source: Clean Energy Australia report 2021<sup>9</sup>*

### Policy framework

The main relevant policy instrument behind these evolutions is Australia's Renewable Energy Target (RET), which is a Federal Government policy designed to ensure that at least 33,000 gigawatt-hours (GWh) of Australia's electricity comes from renewable sources by 2020. The RET consists of two main schemes:

- The Large-scale Renewable Energy Target (LRET) requires high-energy users to acquire a fixed proportion of their electricity from renewable sources.
- The Small-scale Renewable Energy Scheme (SRES) provides a financial incentive for individuals and businesses to install small-scale renewable energy systems such as rooftop solar, solar water heaters and heat pumps.

In September 2019, the Clean Energy Regulator announced that Australia had met the LRET more than a year ahead of schedule. The scheme will continue to require high-energy users to meet their obligations under the policy until 2030.

The SRES is scheduled to run until 2030, with the level of subsidy available falling each year between now and the end of the scheme.

<sup>9</sup> <https://assets.cleanenergycouncil.org.au/documents/resources/reports/clean-energy-australia/clean-energy-australia-report-2021.pdf>

## HEAT/FUEL

Figure 6 shows the role of different fuels/energy carriers for providing heat in different sectors (industry, residential sector, commercial and public services and other). Fuel use by energy producing industries for transformation and for own use is excluded. Mind that electric heating (direct or through heat pumps) is not included in these figures as this is not separately reported in the IEA database.

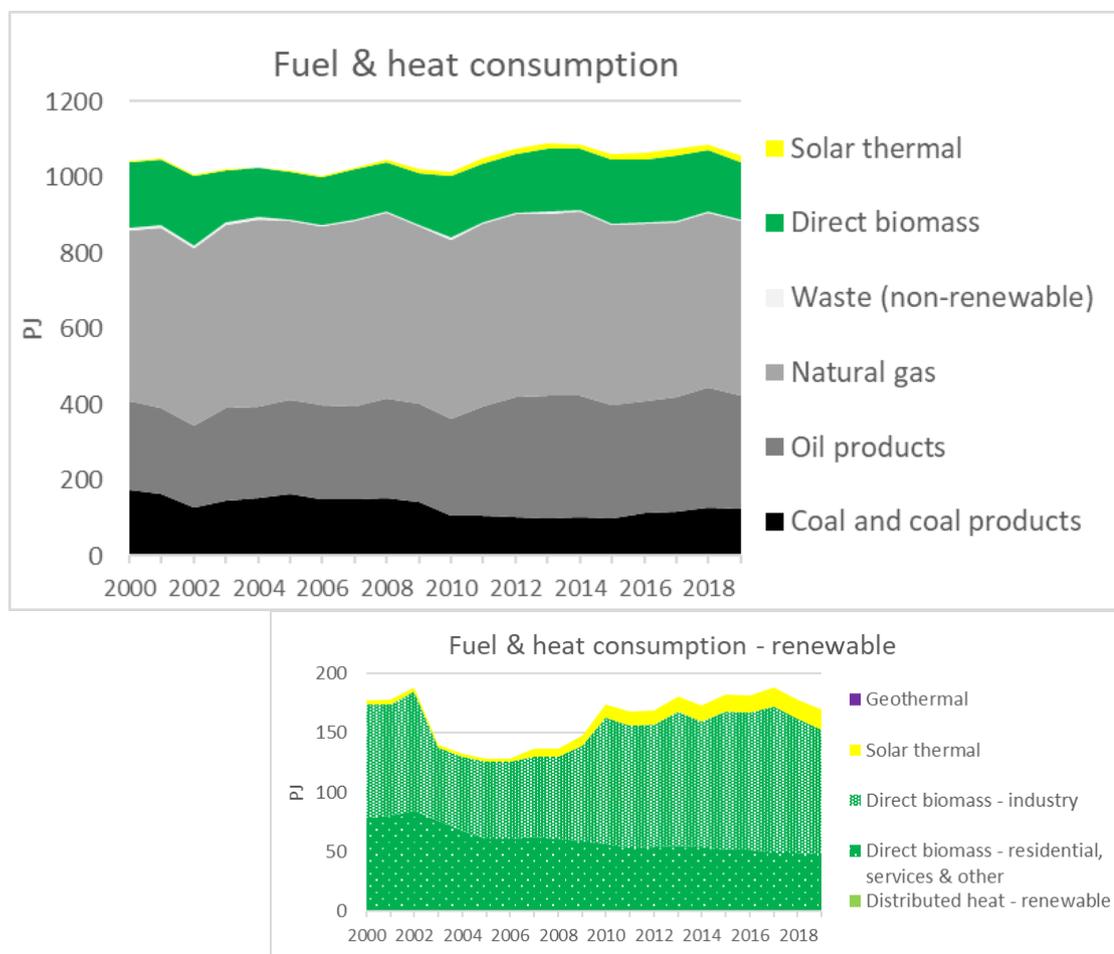


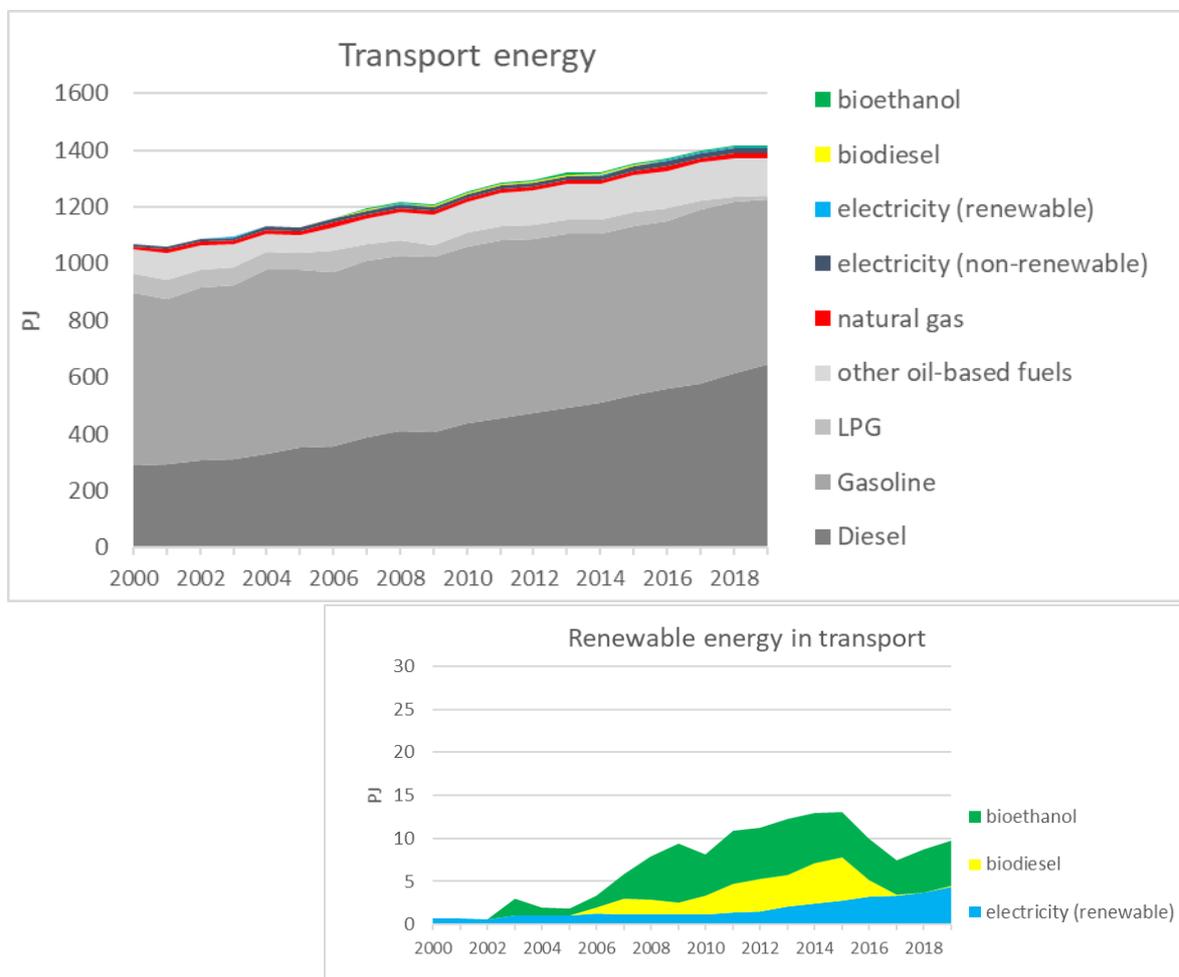
Figure 6: Evolution of fuel and heat consumption in Australia 2000 - 2019 (Source: IEA (2021) World Energy Balances and Renewables Information)

The provision of heat is largely based on fossil fuels, mainly natural gas and oil products. Direct use of biomass represents around 15% (about two thirds of that in industry) and solar thermal 1.5%. The amount of renewable heat was fairly stable in the past decades (with some addition of solar thermal).

There are no specific policy instruments supporting renewable heat in Australia.

## TRANSPORT

Figure 7 shows an overview of the energy used in transport in Australia, split up by different fuels/energy carriers. Transport is almost exclusively running fossil fuels. Diesel consumption keeps increasing every year while gasoline is fairly stable. LPG went down from 3 to 1% of transport energy in the past few years, while other oil-based fuels (mainly jetfuel) are increasing (now at 9%).



**Figure 7:** Evolution of transport fuels in Australia 2000 - 2019 (Source: IEA (2021) World Energy Balances and Renewables Information)

The role of biofuels is marginal (<0.5%). There has been some uptake of biodiesel between 2006 and 2016 up to a level of 5 PJ, but this has dropped to zero. Bioethanol fluctuated between 4 and 6 PJ since 2008.

Electricity represents a share of 1.6% of total transport energy use. This is mostly in rail - the use of electricity in road vehicles is still marginal in 2019 (0.006% of total transport energy use).

### Policy framework

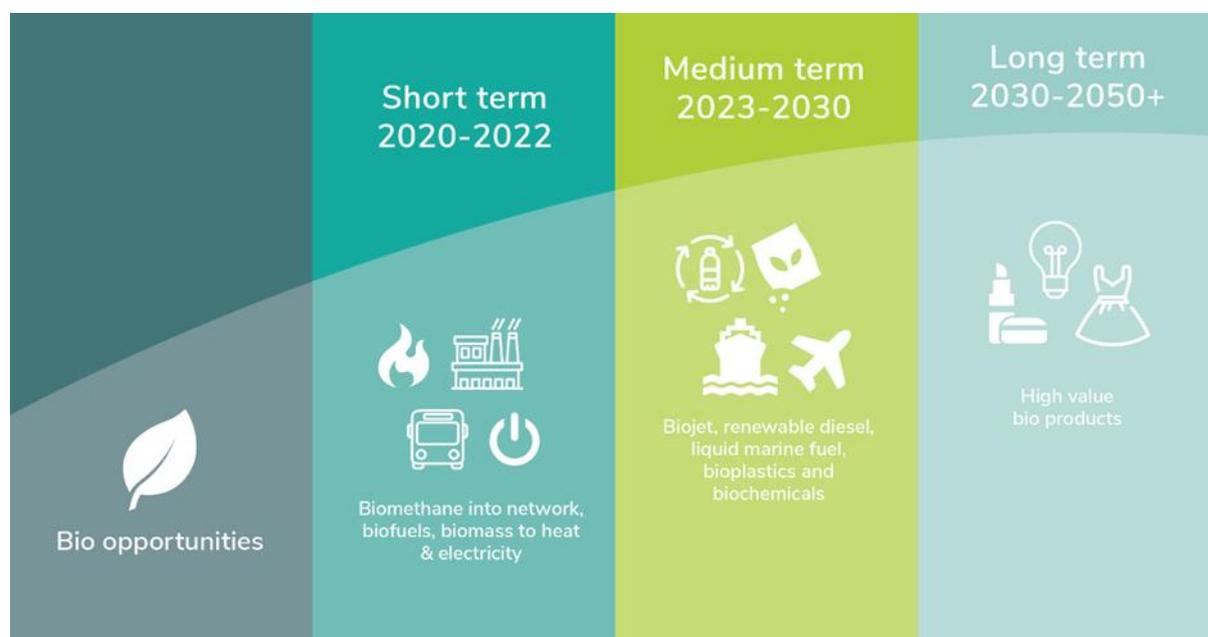
Australia does not have a strong history of policy interventions to support biofuels compared with other nations; however, biofuel blend mandates in Queensland have significantly increased the demand for biofuels while those in New South Wales (NSW) have been challenged by lack of

compliance and missed targets. At the national level, the biofuels sector benefited from the Ethanol Production Grants Program and the Cleaner Fuel Grants Scheme. Until 2015, these provided a full excise rebate on domestically produced ethanol, and biodiesel produced in or imported into Australia. However, the Diesel Fuel Tax Rebate – which applied only to fossil fuel-derived fuels – limited the impact of these policies on the biofuel industry.

A Future Fuels Strategy is currently under development. The strategy sets out the direction and practical actions to enable the private sector to commercially deploy low emissions road transport technologies at scale. Technologies explored in the strategy include battery electric vehicles, hydrogen fuel cell vehicles, and biofuels.

## RESEARCH FOCUS RELATED TO BIOENERGY

The bio-opportunities and focus areas across different timeframes have been identified below.



*Figure 8: biomass based opportunities in Australia*

Technologies are constantly under development to optimise the conversion of organic residues, in conjunction with inorganic wastes, such as plastic and tyres, into renewable fuels and other value-added products.

In addition, bioenergy with carbon capture and storage (BECCS) is receiving increased attention from policy makers and researchers as it is a carbon reduction technology that offers permanent net removal of CO<sub>2</sub> from the atmosphere.

## RECENT MAJOR BIOENERGY DEVELOPMENTS

Various programs administered by federal agencies, such as the Australian Renewable Energy Agency (ARENA) and Clean Energy Finance Corporation (CEFC), play a key role in supporting the development of bioenergy projects.

Latest bioenergy projects supported by ARENA:

- [Malabar Biomethane Injection Project](#) (NSW) - Started 2020. Total project cost \$11.96m
- [Energy from Waste Through Pyrolysis](#) (WA) - Started 2020. Total project cost \$9.4m
- [Renewable Energy for Process Heat Opportunity Study](#) (NSW) - Started 2020. Total project cost \$949k
- [East Rockingham Waste to Energy](#) (WA) - Started 2019. Total project cost \$510.8m
- [Logan City Biosolids Gasification Project](#) (QLD) - Started 2019. Total project cost \$17.28m
- [Commercialisation of Renewable Crude Oil Production](#) (QLD) - Started 2019. Total project cost \$12.29m

More projects and information can be found [here](#).

Latest bioenergy projects supported by CEFC:

- \$57.5 million investment in the East Rockingham Waste to Energy facility (NSW).
- \$90 million debt finance in Australia's first large-scale energy from waste project in Kwinana (WA).
- \$30 million debt finance in Visy's infrastructure project to upgrade the existing recycling infrastructure and the resource recovery equipment.
- \$38 million debt finance in Melbourne's new South Eastern Organics Processing Facility (VIC).
- \$90 million corporate loan to support Cleanaway's sustainable waste management activities (NSW).
- \$30 million debt finance in ResourceCo's PEF resource recovery centre at the Wetherill Park (NSW).

More projects and information can be found [here](#).

## LINKS TO SOURCES OF INFORMATION

CEFC, 2021 - [Energising resource recovery: the Australian opportunity](#)

CEC, 2021 - [Clean Energy Australia report 2021](#)

CEFC & ARENA, 2019 - [Biofuels and Transport: An Australian opportunity](#)

ARENA, 2019 - [Renewable Energy Options for Industrial Process Heat](#)

Bioenergy Australia & ENEA, 2019 - [Biogas Opportunities for Australia](#)

Bioenergy Australia & KPMG, 2018 - [Bioenergy state of the nation report](#)