Bioenergy Australia Pty Ltd
PO Box 127, Civic Square, ACT 2608
Phone: 0439 555 764
Email:
shahana@bioenergyaustralia.org.au

BIOENERGY AUSTRALIA SUBMISSION

Energy Security Board – Post 2025 Market Design

Bioenergy Australia is the national industry association, committed to accelerating Australia's bio economy. Our mission is to foster the bioenergy sector to generate jobs, secure investment, maximise the value of local resources, minimise waste and environmental impact, and develop and promote national bioenergy expertise into international markets.

The purpose of this submission from Bioenergy Australia is to highlight the role of bioenergy in Australia's future energy mix and to advocate for a post 2025 electricity market design which utilises bioenergy's full potential. In particular, bioenergy is uniquely placed as a source of firming power which is already widely developed and can play a significant role in the ancillary services market.

Bioenergy is a cross-sector solution, which can support the state in facing environmental and socio-economic challenges. Bioenergy Australia has recently developed a number of reports to highlight the key opportunities of the development of a national bioeconomy, as well as some recommendations to support the growth of the bioenergy industry. These are listed below, and we encourage the Board to review these in conjunction with our submission.

- Bioenergy Australia submission to the Australian Bioenergy Roadmap
- Bioenergy Australia Economic Recovery Proposal
- Shovel Ready Sample of Bioenergy Projects Across Australia
- KPMG Bioenergy State of the Nation Report
- Biogas Opportunities for Australia Report

Bioenergy is unique in its ability to provide synchronous, baseload and dispatchable renewable electricity. Considering the grid reliability and security benefits associated with this type of generation profile, bioenergy projects must be incentivised through market mechanisms to ensure their full benefits can be harnessed for Australian electricity consumers.

Without market mechanisms which facilitate and reward distributed bioenergy, this unique resource may cease to operate within the national electricity market (NEM) and certainly will not grow. However, if properly incorporated into the Boards proposed mechanisms, bioenergy generation can play an important grid stabilisation and zero emissions firming role in Australia's energy transition.

Over the last decade there has been an increasing proportion of variable renewable energy (VRE) generation in the NEM. This has resulted in

- Declining electricity prices, with more frequent and severe negative pricing events;

- Compromised grid stability, leading to an increase in the frequency of Australian Energy Market Operator (AEMO) interventions; and
- As a result of the above, a decoupling of the energy only price (i.e. generated from VRE) from the inherent services synchronous generation provide to sustain a secure and reliable grid.

As VRE penetration continues to increase, the future market outlook includes:

- A significant decline in large-scale generation certificate (LGC) prices;
- Lower electricity pool prices; and
- Increasing frequency of negative pricing and AEMO interventions.

On this basis, the security and reliability of the grid is at risk as generators which can supply essential grid services become uneconomic. As a result, Bioenergy Australia principally supports the market changes proposed by the Energy Security Board (ESB).

However, Bioenergy Australia is concerned about the ability for, typically smaller sized, distributed generation to participate in market mechanisms such as inertia and system strength and thereby realise the true value of bioenergy as a unique distributed resource.

On this basis, Bioenergy Australia encourages the inclusion of distributed generation in the following market design mechanisms:

1. The integration of DER resources to include 'small generator aggregators (SGAs)', thereby enabling frequency control ancillary services (FCAS) participation
2. A decentralised capacity market
3. A spot market, combined with the ability to hedge, for inertia or synchronous services

Why Bioenergy?

Bioenergy is typically produced from biomass residues and waste materials from primary and secondary production sectors. Bioenergy in relation to the NEM includes electricity generation from biogas (landfill gas or biogas produced through anerobic digestion) or the combustion of biomass residues such as sawmill residues, agriculture waste, construction, or municipal wastes.

Utilisation of organic waste to produce energy can play a central role in the national transition to a circular, low carbon economy. Organic wastes can be converted into renewable, reliable, and distributable source of energy to produce heat, electricity, or transport fuel. They can firm other renewables and play a crucial role in stabilisation of the grid moving forward.

As widely demonstrated by results achieved internationally, the development of a strong bioeconomy can provide skilled employment opportunities to regional areas and stimulate economic development. The International Renewable Energy Agency (IRENA) 2019 review shows global employment in the bioenergy sector has grown in the last few years, reaching 3.18 million jobs in 2018.

Looking at domestic opportunities, the Clean Energy Finance Corporation (CEFC) report "The Australian bioenergy and energy from waste market" estimates that bioenergy has the potential to attract at a minimum $3.5-$5 billion investment, mostly in regional economies and the Infrastructure Partnerships Australia report – putting waste to work showed the investment opportunity in energy from waste of $8.2 billion to $13.7 billion by 2030.

Within the agriculture industry, biogas represents a key employment opportunity for regional areas. By using locally produced waste, the biogas industry supports local economies and regional communities, creating jobs, and offering new income sources, particularly for farmers. Through collaboration with different farms, a regional biogas plant can create different job opportunities along the supply chain, from raw material cultivation and collection, to transport, storage, and pre-processing. By increasing decentralised energy production, income stays in regional areas instead of going to global energy markets. In fact, a study of bioenergy projects in Ireland found 4.2 ongoing direct jobs and 2.1 ongoing indirect jobs are estimated to be created per MWe of capacity (DKM Economic Consultants 2012). In comparison, a typical solar farm requires minimal operations staff, such as the 56 MW Moree Solar Farm which requires 5 employees to operate (0.09 direct ongoing jobs per MWe of capacity) (ARENA, 2019) and a majority of its construction costs are imported solar panels (60%) (The Australian PV Association, 2011 Modelling of Large-Scale PV Systems in Australia.).

More information on bioenergy opportunities in regional areas is provided here.

Biomass can play an important role in the decarbonisation of electricity supply, for example by helping to displace the use of coal in coal-fired power stations and by assisting to stabilise the national grid as it moves towards 100% renewable supply, as a source of clean dispatchable power. The coupling of the displacement of fossil fuels by biomass and carbon sequestration opportunities in dedicated energy crops in marginal, unproductive land to supply feedstock for bioenergy, can make a significant contribution towards national climate mitigation efforts.

Bioenergy is recognised internationally as a key contributor towards the reduction in carbon emissions. The Intergovernmental Panel on Climate Change (IPCC) has estimated substantial global mitigation potential for bioenergy in its series of assessment reports. The IPCC's recent report on meeting a 1.5°C target (SR1.5) identified bioenergy as a major contributor in all scenarios that would meet the Paris Agreement target of "well below 2 degrees". According to the report, "bioenergy use is substantial in 1.5°C pathways […] due to its multiple roles in decarbonizing energy use".

In addition to the waste reduction, investment opportunity, renewable baseload power supply and emissions reduction bioenergy can operate within the existing infrastructure and energy system. It is a fantastic option for transitioning to a renewable grid in a stable and managed way.

Some example projects are listed below.

	Example Bioenergy Sector (not exhaustive)		
Characteristic	Biogas/landfill generation	Sugar mill generation	EfW Generation
Current grid generation	150MW	400MW+	60MW+ SWIS, limited in NEM
Generation potential with optimised market signals	[300]MW+	[100]MW+ and increase to capacity factors of exiting projects	1GW+ in NEM
Generation location	Near Load/Cities	Queensland and Northern NSW	Near Load/Cities
Capacity factors	[75-90] %	[50-90] %	90%+
Main generation type	Reciprocating engine	Steam turbine	Steam turbine
System services	Dispatchability, inertia, frequency control	Dispatchability, inertia, frequency control	Inertia, frequency control
Example project(s)	Wollert (VIC) Bioenergy Facility (7.7MW)	MSF Sugar Tableland Mill 24MW generator	Avertas Energy 36MW and East Rockingham 29 MW generators Perth

This submission has been developed by Bioenergy Australia to provide overarching feedback.
We have not addressed the technical aspects in detail but have instead focussed our submission on the strategic opportunities. The three key areas we have addressed are:

1. Bioenergy's role in delivering essential system services (ESS)
2. Bioenergy's ability to firm up variable renewable energy (VRE) generation
3. Bioenergy as an alternative to ageing thermal power generation

Given the Commonwealth Government is making a record level of investment in driving Australia's bioeconomy through funding the development of Australia's first Bioenergy Roadmap and other initiatives we encourage the Board to consider the opportunity for Bioenergy within the future design of the NEM.

Bioenergy's role in delivering essential system services (ESS)

Bioenergy has an important current and future role in delivering ESS. Given that bioenergy is a renewable source of energy with a stable generation output, it is essential that the future design of the NEM supports bioenergy's provision of ESS, particularly inertia and system strength. It is also vital that bioenergy be able to contribute in markets such as FCAS, due to its stability and ability to be stored.

Bioenergy Australia firmly supports the development of a spot market for the procurement of inertia or synchronous services. A transparent and active spot market will enable the system operator to procure and dispatch the lowest cost services, reducing the impact on consumers. It is also important that the spot market allows those services to be hedged to support the longer revenue streams needed to fund the bioenergy plant.

The provision of these services can be achieved through waste-to-electricity generation plants, which often utilise reciprocating engines to generate electricity. These generators provide critical network stabilisation through inertia, voltage control and system fault ride-through capabilities. When developing the mechanism for inertia or system strength, the technical criteria and ability to participate must include bioenergy participation.

Biogas synchronous generators, by their nature, are electro-magnetically coupled to the power system and therefore can respond and resist voltage disturbances on the network to maintain voltage stability. To provide system stability, biogas-to-energy generators simply need to be online and synchronised to the grid, as synchronous generators increase local system strength and help maintain stable voltages. Most biogas-to-energy power stations are also designed to allow the power station to ride through short term disturbances while remaining connected to the network.

Additionally, bioenergy power station design offers improved power quality, particularly voltage control. This is achieved by managing the power factor at the connection point. Real time monitoring of the network voltage allows many biogas-to-energy power stations to constantly adjust to maintain a very fine voltage tolerance.

With more than 150MW of biogas generating capacity installed across the NEM, there is a significant ability for these generators to provide grid services. Although the current operation of these generators provides these services consistently on a baseload basis, the increasing penetration of VRE and the impact on market and contract pricing means that the future of this capacity is in doubt (i.e. many operators are exploring more variable operation techniques in order to capture intra-day pricing events). On this basis, it is paramount that these generators are not forgotten in the development of the essential services mechanism.

Bioenergy's ability to firm up variable renewable energy (VRE) generation

Over the last decade there has been an increasing amount of variable renewable energy (VRE) generation in the NEM. With wind and solar playing a dominant role in the energy transition, the integration of these intermittent energy sources with the supply grid places significant pressure on grid operation and management. The supply of energy from the wind or sun cannot be controlled, reliably predicted, or managed to meet peak demands for firming supply.

On the contrary, heat and electricity produced from biogas or biomass is dispatchable, therefore strategic use of bioenergy can provide much-needed grid stability to enable further uptake of variable renewable generation to decarbonise the energy system. Being well suited to powering many existing regional manufacturers and communities, bioenergy can play a key role in easing grid demand in strategic locations. Industrial facilities often take advantage of co-location, waste centralisation and cogeneration. Bioenergy assets located in those communities will reduce transmission losses and distribution costs. It will remove demand at the extremities of the grid which would be an attractive outcome to market participants. However, so far little attention has been paid to the possible role of bioenergy as an effective, low carbon and low-cost grid management and energy storage option in Australia.

Under a favourable policy environment, Australian biomass, including wood and paper products, could contribute the equivalent of several thousand GWh in renewable energy per annum in dispatchable form, reducing reliance of non-renewable sources and provide greatly needed "peaking" services.

Bioenergy Australia emphasises the significant role that bioenergy has to play in assisting to address the challenges associated with increasing amounts of VRE. As a low or zero-emissions energy source, bioenergy creates the opportunity for Australia's energy mix to be 100% renewable and can provide many of the same benefits of traditional thermal power generation. Bioenergy technologies have the ability to solve many of the VRE challenges immediately and into the post-2025 future, and future NEM design should ensure that bioenergy is able to participate to its full potential.

More information on the role of bioenergy in supporting the grid is provided here.

Bioenergy as an alternative to ageing thermal power generation

Bioenergy Australia emphasises that bioenergy technologies can act as alternatives to ageing thermal power generation or to support decarbonisation of existing thermal power generation.

The process of converting biomass to heat and/or power is compatible with existing infrastructure. For example, a significant level of co-firing of biomass can be achieved within existing coal-fired power stations with minimal infra-structure change.

Development of biomass-to-power is well advanced worldwide, including in Brazil, China, India, Japan and Canada, but is most developed in central and northern European countries. There, bioenergy including biopower, is playing a major role in achieving national goals of transitioning towards 100% of consumed energy coming from renewable sources and achieving zero net greenhouse gas emissions.

Presently Finland is the leader in percentage of power from biomass, where it provides over 14% of electricity consumed, with much of this produced and used within the pulp and paper industry. Denmark, with 12% of power already from biomass, is increasing this share towards 15%, as the remaining large coal-fired plants are converted to being fired with biomass, and new biomass combined-heat-and-power (CHP) plants are built. Other EU leaders in biopower include Austria, the UK, Germany, Spain and Sweden. Lithuania is an example of a country reliant on nuclear and imported natural gas until about 2000, but that now is expanding generation from biomass towards supplying 12% of power demand (and 50% of heat needs) by 2030. Sweden is also lifting power from biomass capacity to help prevent shortfalls in supply as remaining nuclear plants are closed.

In Japan, Chugoku Electric are one of a number of companies building dedicated new coal / biomass fired power plants. The Chugoku plant has a capacity if 1000MW. 500MW of this will be generated from the combined coal / wood pellet plant.

A significant percentage of power is also being produced in many countries by anaerobic digestion of putrescible wastes, with the biogas produced fuelling gas engine-driven generators. Germany sources over 5% of its power from this source, and France, the UK, South Korea, China and Qatar are among the many other countries that have developed this technology at scale. While putrescibles waste is largely diverted from entering landfill in most EU countries the extraction of landfill gas to produce power continues in countries, including Denmark and Sweden where landfilling waste has effectively now ceased.

Domestically, Cape Byron Power is an example of 100% biomass to renewable electricity. It uses the following fuels that are 100% federally accredited renewable energy fuel sources that comply with Australia's United Nations' obligations under the Kyoto Protocol and Paris Accord;

- Bagasse – the plant fibre left over from the sugar cane harvest each year after the cane juice has been removed by the sugar mills.
- Energy Crops – such as the wood and plant fibre from purpose grown crops (e.g. plantation forestry)
- Woodwaste – waste timber from sawmill offcuts or from local weed removal that has no other economically beneficial use.
- Approved Clearance – the waste fibre left over from already approved infrastructure projects being undertaken in the local area such as new roads, dams, transmission lines and subdivisions that has no other economical beneficial use

Cape Byron power stations in the Northern Rivers region of New South Wales (NSW), together generate enough renewable electricity to supply around 60,000 homes, which is roughly equivalent to the total numbers of homes in the Northern Rivers region. In the local area, Cape Byron Power lowers the risk of power blackouts for the local community and displaces the need to import large amounts of electricity into the local area from coal fired power plants far away from the Northern Rivers, reducing the cost of excessive line losses.

In addition, the Tableland Green Energy Power Plant in Queensland (QLD) converts 100 per cent renewable sugarcane fibre, known as bagasse, into green energy. The power plant produces 24 megawatts of electricity – enough to power 26,280 homes – which is the entire population of the Tableland region.

In the Hunter region of NSW, the Redbank power station will be the largest Biomass fired power plant in Australia once it is restarted. It has the capacity to generate a maximum of 151 MW gross power and is capable of supplying power to 250 000 homes. With the feedstocks including forestry and sawmill residues, uncontaminated wood waste from pre-consumer manufacturers, residues from cultivated burned forests, wood waste from approved clearings for infrastructure projects and other Environment Protection Authority (EPA) approved biomass from construction and demolition waste.

Redbank and its FiCirc Fluidised bed technology is an ideal base load station providing reliable power 24/7. Due to the large volumes of biomass required and distances involved for transportation of the fuel, it will be necessary to have incentives and rewards for dispatchability and reliability as a base load station, for its continual existence and grid support. Hunter Energy's ultimate goal is to develop Redbank into a green energy park where the existing biomass fired power plant will generate approximately 1 000 000 MW hours with net zero emissions and a saving of 943,023 GHG emissions (tCO2-e/y) by not burning coal tailings. This will be enhanced by a solar farm installation, gas turbines utilising waste mine gas and a battery storage system (electrical or thermal storage) to complete its portfolio. This will be a major establishment capable of supporting grid system stability and reliability that should be incentivised.

Internationally with the increased deployment of biomass for electricity and heat generation, enhanced sustainability criteria have also been developed globally. For instance, the Renewable Energy Directive (RED II) produced one of the most stringent set of sustainability criteria for solid biomass ever promulgated by any political institution. The new directive successfully established the first European-wide sustainability criteria for solid biomass which ensures that biomass is produced sustainably, irrespective of its geographical origin. Concretely, this means that bioenergy producers must prove that they use biomass from sustainably managed forests, maintaining a carbon sink and achieving significant levels of greenhouse gas emissions savings as compared to fossil fuels.

In addition to ensuring that future NEM design accounts from ageing thermal power generation going offline, it should also utilise bioenergy technologies to lessen the effects of thermal generators shutting down.