BIOENERGY AUSTRALIA SUBMISSION - Bioenergy Roadmap

June 2020

Bioenergy Australia is the national industry association, committed to accelerating Australia’s bioeconomy. 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.

Bioenergy Australia welcomes the development of a first-ever national Bioenergy Roadmap, which will identify the role that the bioenergy sector can play in Australia’s energy transition and in helping Australia meet its emission reduction commitments, while leveraging the significant and multi-faceted opportunity. Bioenergy has the potential to attract at a minimum $3.5-$5 billion investment, mostly in regional economies. Following the recent devastating bushfires and the COVID-19 crisis, the roadmap presents Australia with a critical recovery opportunity to invest in developing domestic industries, such as the bioenergy sector, for significant and sustained job creation and economic stimulus, while boosting our self-sufficiency in fuel, gas and energy and other key production industries manufacturing high value products and chemicals such as medical grade ethanol used in hand sanitiser for our front-line workers.

Bioenergy Australia congratulates the Federal Government and the Australian Renewable Energy Agency (ARENA) for supporting the development of the Bioenergy Roadmap. We look forward to working with ARENA and the appointed consultants as the Roadmap develops over the coming months.

As Bioenergy Australia is a key stakeholder in the development of the Bioenergy Roadmap, we see this submission as a formal response highlighting the wide-ranging opportunity Australia’s potential bioeconomy can provide. Our participation in the development of the Roadmap is not limited to this submission, and includes regular engagement with ARENA and the consultants, participation in the reference group and reviewing of drafts prior to release.

Bioenergy Australia would like to reinforce the key deliverables we are looking to see in the Roadmap:

1. Identification of the elements of the bioeconomy that present the greatest opportunity in Australia across the short, medium and long term
2. Strong economic modelling to highlight the investment and employment opportunities
3. Identification of regulatory and economic barriers to the deployment of the bioeconomy
4. Identification of policy mechanisms to support the development of the industry
Key benefits of investing in the bioenergy industry:

- Substantial and sustained job creation, especially in regional Australia
- Secure, affordable, and reliable domestic energy sector
- Residual resources diversion and conversion of biomass to valued products
- Emissions reduction

Main sectors where bioenergy technologies can assist in achieving these goals:

- Transport (ethanol, biodiesel, renewable diesel, biojet, biomethane)
- Heat and power (biomass residues, including forest and agricultural by-products, biomethane)

Bioenergy Australia recommendations on how the Government can support:

- National Clean Futures Target, including:
  - Clean Fuels Target
  - Renewable Heat Target
  - Green Gas Target
  - Net Zero Organic-to-Landfill Target
  - ERF/CSF Jobs Target

- National Bio Industries Fund to:
  - Upgrade existing facilities in bio-based industries to increase productivity and reduce costs
  - Undertake feasibility assessments for converting low-value residues into new energy products under a circular economy approach
  - Undertake new project development of replicable low cost, high value projects such as anaerobic digestors for local councils, food and agriculture processing facilities and wastewater treatment

- Additional stimulus mechanisms, including:
  - Mandate a portion of clean fuels across fleet and procurement contracts for the Federal Government
  - Excise reduction support extended to renewable diesel, BioCNG and BioLNG and incentives to produce SAFs
  - Provide funding for the development of the Clean Fuels Challenge and Clean Fuels Network
  - Develop a renewable gas certification system
  - Develop a renewable gas injection tariff
  - Implement a ‘gas swap’ model for biomethane and natural gas

These recommendations are put forward without the benefit of the economic modelling of the Roadmap, or the outcomes of all the workshops and consultation. Therefore, Bioenergy Australia has an open mind about which elements of the bioeconomy present the greatest opportunity in Australia across the short, medium, and long term, and therefore which policies may be needed to unlock those opportunities. We welcome the opportunity to further engage as the Roadmap reaches the prioritisation and policy stage.
Q.1 > What are the key drivers and impediments to bioenergy development in Australia?

DRIVERS

In accordance with the priorities presented in the Technology Investment Roadmap, recently released by the Federal Government, Bioenergy Australia has identified the following drivers for the development of a bioeconomy in Australia:

- **Substantial and sustained job creation, especially in regional Australia**

The feedstock used for bioenergy often stems from rural and agricultural activities, and can be associated with existing or new manufacturing processes. Development of bioenergy can provide skilled employment opportunities and stimulate economic development through the delivery of revenue streams outside of traditional sources.

This point is further discussed in Q.5.

- **Secure, affordable and reliable domestic energy sector**

National energy security can be enhanced through the production of renewable energy from a domestic energy source such as biomass. In particular, domestic production of biofuels results in less reliance on imported oil and petroleum products thereby promoting energy security. Heat and electricity produced from bioenergy is dispatchable, with the latter typically being generated through synchronous means. Strategic use of bioenergy can provide much-needed grid stability to enable further uptake of variable renewable generation to decarbonise the energy system. In addition, the Coronavirus pandemic has highlighted vulnerabilities in Australia’s supply chains to outside shocks and has revealed a need to pursue national self-sufficiency and enhanced energy security.

This point is further discussed in Q.5.

- **Residual resources diversion and conversion of biomass to valued products**

Bioenergy is typically produced from biomass residues and waste materials from primary and secondary production sectors, as well as municipal and industrial waste. This delivers economic benefit from otherwise unusable resources and can significantly reduce landfill and other demands for waste storage.

The 2018 National Waste Report estimates that in 2016-17 Australia produced 67MT of waste with 13.8 MT being Municipal Solid Waste (MSW). Approximately 42% of this material went to landfill, creating poor environmental outcomes, including large greenhouse gas emissions. The waste sector in Australia contributes 2.4% of our national emissions.\(^1\) Instead, it could be used to abate Greenhouse Gas (GHG) emissions and recover valuable nutrients.

In accordance with the waste hierarchy, waste should be recovered for its highest order use wherever it is economically feasible to do so. Therefore, once the point is reached where no more recoverable

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value can be extracted economically or environmentally sustainably from residual waste, the recovery of energy from waste is a desirable alternative to landfill whilst delivering economic benefit. Furthermore, this energy generated from waste could displace fossil fuel energy transformation. Bioenergy is a commercially viable solution that demonstrates how a circular economy functions, recovering resources at their highest order use.

Utilisation of organic waste to produce energy can play a central role in the national transition to a circular, low carbon economy. Organic waste can be converted into biogas, which is a renewable, reliable and distributable source of energy used to produce heat, electricity or transport fuel. Biogas can also be upgraded into biomethane: a gas with a chemical composition very similar to natural gas. Biomethane can be used on-site, using existing infrastructure, or injected into the gas grid, serving several uses for consumers such as heating, industrial power or fuel for gas converted vehicles. In addition, technologies are 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. A few examples include:

- Licella (an Australian technology development company) has recently formed a joint venture, iQ Renew (iQR), to construct an end-of-life waste to fuels plant in Australia that will be able to produce low sulphur fuels for the Australian shipping industry. This follows on from their announcement of collaboration with Neste, the world’s leading producer of renewable diesel, and UK-based chemical recycling company ReNew ELP in a development project to explore the potential of using mixed waste plastic as a raw material for fuels, chemicals and new plastics.
- Mercurius Australia has teamed up with Australian company Southern Oil Refining and MGC from Japan and KOLON from South Korea to further develop its REACH™ technology converting waste biomass (sugarcane bagasse, x chips) and biogenic MSW into diesel, jet fuel and renewable chemicals and plastics. Southern Oil Refining is Australia’s leading producer of recycled fuels and owner/operator of Australia’s only biofuels testing refinery located at Yarwun QLD. Southern Oil has successfully refined a number of post-consumer waste feedstocks into 100%drop-in diesel.
- Boral Australia is conducting an ARENA-funded feasibility study in the use of Global Ecofuel Solutions (GEFS’S) mechanical catalytic conversion process (MECC) technology to convert hardwood sawmill residues into renewable diesel. The MECC technology is robust and can utilise forestry and agricultural residues and solid municipal organic waste streams such as contaminated paper and plastic.
- Fischer-Tropsch (FT) technology is used to convert municipal solid waste (MSW) into sustainable aviation fuel (SAF) – Fulcrum is the leading example of this in the US. The FT process has been used for over a century in the oil sector. MSW converted to SAF through this process can reduce greenhouse gas emissions by 80% relative to conventional jet fuel.
- Frontier Impact Group recently received a grant to develop a commercially proven high temperature pyrolysis technology that will use biomass to convert to a syngas and then to a drop in diesel fuel on site. This will produce 18 M litres of drop in diesel fuel and a pipeline of over another 100 M litres of fuel in that already being developed.

More information on the role of bioenergy in the national waste strategy is provided here.

- **Emissions reduction**
  
  Sustainably sourced biomass used for bioenergy contributes to climate change mitigation, because the carbon emitted when biomass is combusted is taken up when the plants are regrown, as described
in Q9. Thus, bioenergy supports a transition to a low carbon economy resulting in a range of positive environmental and social impacts as well as reducing demand for petroleum-based products.

Bioenergy is recognised internationally as a key contributor towards the reduction in carbon emissions. The IPCC has estimated substantial global mitigation potential for bioenergy in its series of assessment reports. 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”. Bioenergy contributes upwards of 23% of total primary energy supply in Denmark and 30% in Brazil.

The multiple biomass feedstocks, transformation options and utilisation opportunities are shown in the following figure taken from the IPCC report.2

As an example, biofuels derived from biomass and other waste sources can be used in the transport sector as a replacement for conventional fossil-based fuels, with the opportunity to deliver a significant reduction in GHG emissions and to assist with the transition towards a net zero emissions transport system. This is due to the production of biofuels like bioethanol, biodiesel and renewable diesel having a lower carbon footprint than equivalent fossil-based fuels, according to independent LCA reviews.

International programs supporting biofuels have proven to be particularly successful in reducing GHG emissions. As a reference, in 2010 California adopted a 10% reduction in carbon intensity by 2020 under the Low Carbon Fuel Standard (LCFS). Since it was adopted, the LCFS has reduced carbon pollution emissions in California by more than 30 million metric tons, equivalent to removing 6.4 million gasoline–fuelled cars from the state’s roads per year. The success of this policy has led to a new target of 20% reduction in the state’s transportation fuel carbon intensity by 2030. This policy is also credited with kickstarting the sustainable aviation fuel industry in California. In addition to State based policies such as the LCFS, the US Federal Government created the renewable fuel standard (RFS)

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2 https://www.ipcc.ch/site/assets/uploads/2018/03/figure-02.02.png
program to reduce greenhouse gas emissions and expand the nation’s renewable fuels sector, while reducing reliance on imported oil. The EPA administers the RFS program, which sets a target of 36 billion gallons of renewable fuel by 2022. This program has delivered significant investment and helped the agricultural industry diversify their income.

The Renewable Energy Directive (RED II) sets rules for the EU for years 2021-2030. EU member countries must require fuel suppliers to supply a minimum of 14% of energy consumed in road and rail transport by 2030 as renewable energy with many member countries currently deciding to significantly exceed the target. Under the European Green Deal the EU will likely significantly strengthen its emission reduction targets.

Adoption of similar policies in Australia would enable a significant emission reduction from the transport sector. The QUT discussion paper “Biofuels to bioproducts: a growth industry for Australia” highlights that the full implementation of an Australia-wide E10 and B10 mandate would correspond to a reduction of, respectively, approximately 2.6 million tonnes and 6.3 million tonnes of greenhouse gas emissions per year. Bioenergy Australia believes that Australia has great potential to develop and deploy low carbon, combining forces with the ambitions of other forward-looking jurisdictions and significantly exceed a 10% share of biofuels in transport from 2025 onwards.

Biofuels can also contribute to the decarbonisation of the aviation and marine industry. The CEFC report “Clean energy and infrastructure: Pathway to airport sustainability” concluded that sustainable aviation fuels could reduce the carbon footprint of aviation fuel by up to 80%. As an example, United Airlines have entered into two agreements in California to reduce its emissions through increased use of sustainable aviation fuels (SAFs). They extended their agreement with World Energy to uptake 35 million gallons of SAF over five years, achieving more than 60% reduction in greenhouse gas emissions on a lifecycle basis. They also invested $30 million in California-based Fulcrum Bioenergy, securing access to 1 billion gallons of sustainable aviation fuel over ten years that will reduce greenhouse gas emissions by over 80% compared to conventional jet fuel. Similar outcomes can be achieved in the shipping sector. As an example, German carrier Hapag-Lloyd has embarked on the use of biofuel as marine fuel as part of the company’s efforts to reduce emissions of carbon dioxide (CO2) from its ships. Hapag-Lloyd said it has tested a blend of 80% low sulphur fuel oil (LSFO) and 20% biodiesel (based on cooking oils and fats) to create a so-called B20 fuel, used for the first time on the 4,402-teu (20 ft equivalent unit) Montreal Express shipping vessel. The biodiesel generates up to 90% less CO2 emissions than conventional bunker fuels. This initiative is in response to the IMO’s target of at least a 50% reduction in GHG with a goal of 70% by 2050, with Maersk (the world’s largest shipping line) announcing it will be carbon neutral by 2050. Minimising the carbon footprint of aviation and marine fuels is beneficial not only to meet the national and international emission reduction targets but also to facilitate exports, as the importing countries are more likely to choose these products over others with a higher carbon footprint. It also represents a significant opportunity for Australia to be able to produce these fuels of which there is a global shortage.

Decarbonisation opportunities are not limited to the transport sector. Biogas can be upgraded to natural gas quality and injected into the gas grid to provide net zero carbon energy for gas consumers, such as industry, households, commercial operations and even transport and electricity generation. As outlined in the recent report “Mapping the state of play of renewable gases in Europe”, the process is well established in Europe with over 1,000 plants operational. More information can be found in the ‘European Biomethane Map 2018’. According to the Deloitte Access Economics report “Decarbonising Australia’s gas distribution networks”, biogas blending/injection is currently the cheapest option for decarbonisation of the gas networks.
Biomass also represents a key opportunity to decarbonise industrial processes as it can produce process heat that would otherwise use fossil fuels such as natural gas, Liquified Petroleum Gas (LPG), Liquified Natural Gas (LNG) or coal. For instance, the conversion of a solid biomass fuel in a boiler can deliver the same quality of thermal energy as is generated by a natural gas boiler but often at a significantly lower cost per unit of energy delivered (average reduction of the energy costs between 60 and 70% compared to natural gas in the East Coast).

- As an example, MSM Milling is one of the first examples of a large Australian agricultural company reducing its costs and environmental impact by using biomass for thermal energy. The project involved the installation of a 4.88MW boiler to generate the steam needed for its canola processing operation using local renewable wood waste. The boiler delivers a 70% reduction in thermal energy costs and will result in net emissions reductions of more than 80,000-tonnes of carbon dioxide equivalents during the life of the project (the equivalent of removing 1,500 cars from the road each year).

Finally, biomass can also play an important role in the decarbonisation of electricity supply, for example by displacing 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.

More information on the role of a potential bioeconomy in decarbonising Australia’s energy mix is provided here.

IMPEDIMENTS/CHALLENGES

On a number of metrics, the development of the Australian bioenergy sector is substantially lagging behind other Organisation for Economic Co-operation and Development (OECD) and IEA member countries. This is mainly due to financial, regulatory, supply and institutional barriers. In particular, Bioenergy Australia has identified the following impediments to the development of a strong bioeconomy in Australia:

- Previous absence of political direction and support
- Lack of consistent policy support at the Federal and State level to drive investment in the industry
- Massive inertia due to incumbent market participants
- Significant challenges in access to market for bioenergy products such as fuel, gas and electricity due to high competition with fossil fuel markets
- Existing/previous policy mechanisms have dealt with specific sectors to decarbonise such as RET (electricity) but did not support baseload electricity, heat, transport fuels, gas etc
- Access to development capital
- Disagreement within industry on best use of feedstock
- Regulatory barriers and level of understanding of bioenergy within state-based EPA’s (e.g. the classification and use of digestate as a fertiliser, see Q.5 for more detail)
- Politicisation of energy, climate change and environmental policy
- Bioenergy currently sits under a number of portfolios – a higher degree of coordination is needed to ensure strategies are well aligned
• Slow uptake of commercial energy technologies in Australia, or rather, the risk adverse investment environment within the Australian energy industry, lagging behind international uptake
• The current Australian bioenergy market is small, geographically disparate and lacking a tradeable environmental commodity which would encourage an increase in market participation
• Some forms of bioenergy (e.g. biomethane delivered through a multi-user gas networks) are not recognised as zero-carbon fuel under existing frameworks (e.g. NGERs) which limits its demand as a low carbon alternative option for natural gas consumers. Cost, availability and the small number of gas scrubbing technology providers are a barrier to biomethane pipeline injection
• Lack of education of the community and industry on the opportunities and benefits that bioenergy provides as well as feedstock availability and waste management opportunities
• Lack of incentives for farmers to participate in bioenergy production, including energy cropping and confidence that a long-term market exists for agriculture waste. As an example, the lack of incentives for biogas uptake makes investment in larger projects challenging, due to risk in feedstock certainty and aligning downstream demand commitment to make projects bankable
• Poor identification and promotion of regional bioenergy hubs
• Insufficient development and implementation of municipal solid waste (MSW) source separation programs and policies
• Limited, or no access, to mature and well-established markets in the international scenario

Q.2 > What supply chain gaps act as impediments to bioenergy development in Australia?

Bioenergy Australia identifies the following supply chain gaps acting as impediments to bioenergy development:

• Lack of broad industry and community understanding of the value of biomass that maybe currently classified and treated as waste
• Operational knowledge of bioenergy industry and in many cases of the resource industry not used to handling material typically available for bioenergy
• Without well-developed demand, efficient material collection, handling and transport are economically challenging for small demonstrations or start-ups
• Transport infrastructure limitations (high volume and low-density materials typical of many biomass supply chains are expensive to transport any distance). These also include lack of infrastructure to blend and store aviation fuels near or at the airport to enable certified drop in fuels.
• Limited contractors with experience in building bioenergy projects
• Limited operators with experience in operating bioenergy projects
• Limited experienced investors at both the development and construction stages, based on a lack of successful projects in the market
• Inability to secure long-term feedstock supply
• Lack of standards for bioproducts and intermediates limiting trading
• Inability to ‘freely’ trade and deliver bioenergy to all market participants that purchase the underlying energy commodity. As an example, the potential supply of biomethane and other forms of bioenergy that can be easily exchanged with fossil fuels are not fully realised due to
high transportation costs in physically delivering the renewable product to target markets. In order to increase the addressable market for biomethane, we support the “gas swap” model presented in Q.14.

**Q.3 > What are the competitive advantages of bioenergy in specific end-use sectors (such as biogas to displace natural gas and liquid fuels to decarbonise transport)?**

Australia has five domestic energy use pathways – solid, liquid, gaseous, electricity and direct use renewables. Setting aside the direct use renewable pathway, each pathway needs to undertake a decarbonization journey if Australia is going to meet its COP21 commitments, and they all have unique requirements which can be met through the range of technologies grouped under the bioenergy banner.

The recently released federal government Technology Roadmap Discussion Paper shows that the predominant decarbonization pathway proposed for the Australian domestic energy industry tends to focus heavily on the electrification of non-electricity pathways, with electricity generated via direct renewable electricity generation technologies. To put this challenge into perspective, doubling the current annual electricity end use of 835PJpau would only address one quarter of total non-electrical energy end use in Australia. Developing renewable energy technologies to decarbonize these other energy pathways, hence utilizing existing infrastructure with inherently energy efficiency transport and low cost energy storage characteristics, represents a complimentary approach to decarbonization of the Australian Energy Industry – a complimentary approach which bioenergy can provide.

Examples of the competitive advantages offered by bioenergy technologies in different end-use sectors are provided below.

**Gas**

Biogas and biomethane have the potential to rapidly decarbonise a number of hard to decarbonise sectors rapidly, as they are already connected to existing gas infrastructure. These sectors include:

1. Industry – natural gas is widely used for industrial processes, and biomethane is the cheapest decarbonisation option for most applications. Other advantages of utilising biomass in industrial processes include reduced waste disposal costs and additional value derived from Australian goods being produced using green energy. As an example, farms have the opportunity to utilise their biomass to produce fuel to power pivot irrigators, as biogas for tractors and to power operations such as dairy farms. Bioenergy can enable regional farming to be more sustainable and less susceptible to the changing price of fuel.

2. Dispatchable energy – gas is increasingly important to create a stable and affordable electricity system. Biomethane through existing gas connections to peaking plants can provide dispatchable renewable electricity when the sun is not shining, or wind is not blowing.

3. Commercial and residential heating – biomethane can be delivered to any consumer on a natural gas network seeking to decarbonise their energy supply. A voluntary retail market for clean and renewable energy is maturing across Australia. The gas network provides energy retailers with increased opportunity to offer their customers clean, zero-carbon gas supply by using biomethane.

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The gaseous energy pathway has the opportunity to not only take on existing biogas and biomethane technologies to decarbonize the domestic gas market without the same integrity and appliance constraints as green hydrogen, but it can also support the growing green hydrogen industry through ongoing development of methanation technologies which can simultaneously remove the gas specification risks of both biogas and hydrogen. The decarbonisation of all three non-electricity energy pathways enable the decarbonisation of the electricity energy pathway when used as fuels for generation. Bioenergy fueled electricity generation often takes the form of synchronous generation which is critical to stabilize electricity transmission and distribution networks.

**Transport**

While electric and hybrid vehicles are expected to be an increasingly popular low carbon option in the light vehicle transport sector, aviation, shipping, and long-haul heavy haulage will rely on alternate renewable fuel sources to meet emissions reductions.

As part of the global decarbonisation process, the international aviation industry has committed to reducing its greenhouse gas emissions. The aviation sector currently contributes 2 per cent to global emissions. However, unlike the land transport sector, airlines have limited options to materially reduce emissions other than through the use of aviation biofuels. As other sectors decarbonise, aviation will provide a larger share of global emissions. Bio-based aviation fuels can significantly contribute to a substantial decrease in global CO₂ emissions. The establishment of a domestic bio-jet fuel industry is critical. Australian airlines uplift 9,000 million litres of jet fuel per year creating a significant opportunity for a domestic biofuels sector. The global aviation industry has committed to carbon neutral growth from 2020 and a 50% reduction in CO₂ emissions by 2050 (relative to 2005 levels). Domestically, the Qantas Group has set a target to achieve net zero emissions by 2050 and committed to invest $50 million in the development of a sustainable aviation fuels industry in Australia.

The maritime industry is facing a similar imperative for transformation. LSF2020 refers to the new ‘Low Sulphur Fuel’ regulations, which came into effect on 1 January 2020. These regulations are the biggest of a series of steps by the International Maritime Organisation to reduce marine pollution (MARPOL) in response to the threat of climate change. The LSF2020 emission regulations mean ships will have to significantly reduce emissions on the high seas as well as in coastal areas. With Australia bunkering around a million tonnes of marine fuel oil p.a., this is a significant opportunity for the biofuels sector.

In addition to the above-mentioned opportunities in the aviation and shipping sector, biofuels are market-ready and cost-competitive alternatives to fossil fuels for heavy haulage as well. Since batteries are currently not viable for heavy vehicles due to their range and recharging time, BioCNG and BioLNG from biomethane represent a significant opportunity to replace CNG and LNG, as they are available now and proven and well established in Europe and North America. Further, biomethane can be processed into heavier hydrocarbons such as biodiesel and methanol, using proven Fischer-Tropsch processes. By consolidating biomethane supply into a natural gas network, industry can develop large scale biorefineries for the creation of clean and affordable transportation fuel. International truck companies are already embracing bioenergy as low-carbon fuel for their vehicles and there is no impediment to a similar trend in Australia. Scania, a world leading provider of transport solutions, has demonstrated that it is possible to operate trucks and buses in Sweden on biofuels and reduce environmental impact cost-effectively. Their strategy involves supplying engines running on all

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commercially available fuel alternatives, including compressed and liquefied biogas and natural gas, biodiesel, and ethanol. The company has recently released an alternative fuel engine option for the new truck generation and Euro 6 emissions standard. The new bioethanol engine delivers a similar thermal efficiency as its diesel counterpart.

An exciting development in Australia, introduced by Frontier Impact Group, is the commercially proven high temperature pyrolysis technology that transitions biomass to a ready to use drop in diesel produced at a competitive price. The first project will be at Collie, WA. As the processing plant is able to produce ready to use drop in diesel this will be used by heavy haulage trucks, and use in railways is being explored. In other locations there is the opportunity to use the fuel for shipping or airlines given the quality of the renewable fuel that is being generated.

Heat

According to the report “Renewable Energy Options for Industrial Process Heat” prepared for ARENA in 2019, bioenergy systems are the largest source of existing renewable process heat and are increasingly adopted where a low or zero cost biomass resource is available. In such cases they are often already cost competitive with gas or other fossil fuel sources. The long-term limiting factor on bioenergy adoption is the size of the biomass resource. However, there is scope for much more uptake. Meeting up to around 30% of total national heat demand is technically possible.

There are numerous benefits to using biomass instead of fossil fuels like oil, coal and gas for providing heat for homes, commercial users and industrial processes. In addition to utilizing a locally available renewable energy resource, the use of biomass for thermal energy meets many contemporary environmental and economic goals. Biomass heating and combined heat and power (CHP) can stimulate regional economies, create jobs, offset fossil fuel imports, and promote the sustainable use of our natural resources.

Q.4 > What trends in the electricity, heat and transport markets will impact bioenergy development to 2030 and to 2050?

The bioeconomy has many interactions with the renewable energy sector. The ones that most likely will impact bioenergy development are discussed below.

- Despite the wake of lower battery costs and promising developments in electrification, a vast majority of the global vehicle fleet still uses internal combustion engines, and liquid fuels will be in demand for quite some time. Biofuels can play an important role, not only in the transition period but also in the long-term for transport sectors where electrification is not a viable option such as marine and aviation. In these sectors, which are responsible of approximately 50% of the transport emissions, batteries are sufficient only in certain niche segments, and liquid fuels with their high energy density will be necessary in the foreseeable future. The only alternatives to fossil fuels are biofuels. Hence, the aviation and marine sectors will be a source of growing biofuel demand in the medium to long term.

- Even though costs of wind and solar have come down, both depend on weather and thus are not dispatchable. In contrast, biomass-based electricity generation is dispatchable, and so has an important role to play in stabilising the grid.
- As highlighted in the Energy Network’s Australia decarbonisation strategy, biomethane stored in a natural gas system can be used to supply dispatchable natural gas peaking generation and can play a key role in supplying industry where the heat derived from gas cannot be effectively and efficiently replicated by electricity. When coupled with low-cost non-firm solar or wind generation, this configuration could provide a cost-effective, reliable renewable energy solution that can replace coal fired, base-load electricity.

- Federal and State Governments are currently working on developing targets and agreements, which will likely support the national bioenergy industry. As an example, the NSW and Federal Governments are jointly funding over $2 billion in energy and emissions reduction initiatives, while also ensuring NSW has a reliable and affordable energy system. A new memorandum of understanding (MOU) sets out a clear, long-term path to help the State meet its target of net zero emissions by 2050. The MOU will see reduced emissions across key sectors, including agriculture, mining, and transport.

Q.5 > What markets should Australia’s bioenergy industry focus on? Domestic market, import replacement and/or export opportunities? What are the opportunities for regional economic development, employment and energy requirements?

Australia’s bioenergy industry should mainly focus on the domestic market as bioenergy can strongly benefit regional Australia in economic development, employment and energy requirements.

- Economic development and employment

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 through the delivery of revenue streams outside traditional agriculture, forestry and waste sources. The International Renewable Energy Agency (IRENA) reviews renewable energy and jobs on an annual basis. Its 2019 review shows the global employment in the bioenergy sector has grown in the last few years, reaching 3.18 million jobs in 2018.

A US Department of Agriculture (USDA) report “An Economic Impact Analysis of the US Bio-based Products Industry (2018)“ analyses the economic impact of the biobased products industry on the US economy. Results show that an expanding bioeconomy leads to higher revenues, more jobs, innovative partnerships and key environmental benefits. The total contribution of the bio-based products industry to the US economy in 2016 was $459 billion, a 17% increase from 2014, and it was employing 4.65 million workers (direct and indirect), an increase of more than 10% from 2014.

According to the ARENA and CEFC report “Biofuels and Transport: An Australian opportunity“, global employment figures suggest an Australian biofuels production target of 20 gigalitres per year could provide long-term employment for up to 250,000 people, mostly in regional areas.

In addition to the transport sector, significant employment outcomes can be achieved in all industrial processes that convert residual wastes into a form of energy such as heat, electricity, or alternative fuels. The scope of Waste to Energy (WtE) is very wide, encompassing mature technologies, eg. thermal processing for heat and power and anaerobic digestion to generate biogas, as well as emerging techniques, such as fast pyrolysis, hydrothermal liquefaction (HTL) and gasification. All these WtE options bring significant benefits in terms of long-term employment opportunities.

The World Energy Council report “World Energy Resources - Waste to Energy“ estimates that the typical direct employment for a waste combustion plant of 50,000 tonnes per annum capacity would
be 2 to 6 workers per shift as well as additional indirect jobs in administration, feedstock aggregation, transport and storage. For a 24-hour operation, a typical plant would work on a three shifts system. In the United States, the WtE sector employed around 5,350 people nationwide, working at 85 specific sites (2014 estimates). There were also additional 8,600 jobs created outside the sector, or 1.6 extra indirect jobs for every direct employee. These jobs generated by the sector are usually stable and support the local economy.

According to the IRENA, the biogas sector represented about 333,000 jobs globally in 2016. China accounted for slightly less than half of these jobs, with 145,000 estimated direct and indirect jobs in that nation’s biogas industry. In the United States, the construction and operation of biogas plants in 2016 supported around 7,000 jobs according to the American Biogas Council.

More information on job opportunities in different bioenergy sectors is provided [here](#).

- **Energy security**

The Coronavirus pandemic has highlighted vulnerabilities in Australia’s supply chains to outside shocks and has revealed a need to pursue national self-sufficiency and enhanced energy security. This is particularly relevant in the transport sector as well as for industry and manufacturing which all demand reliable, low cost, low emissions heat, fuel and power. As highlighted in the report “[Bioenergy & Sustainability: bridging the gaps](#)”, bioenergy plays a key role in enhancing energy security.

Looking at the transport sector, Australia imports the majority of its fuel. This not only represents a sovereign security risk, but also constitutes a loss of potential economic activity in Australia. A strong biofuel industry can help diversify the sources of transportation fuels and decrease Australia’s dependence on petroleum imports, which will reduce the risk of supply constraints during times of international or regional geopolitical upheaval. According to The Queensland University of Technology (QUT) report “[Biofuels to bioproducts: a growth industry for Australia](#)”, the implementation of a nation-wide mandate for 10% ethanol blending in petrol alone, as has been achieved in the US, could reduce automotive gasoline imports by about 18% annually and contribute to enhanced domestic fuel security.

Electricity and heat produced from bioenergy can also provide a robust contribution to strengthening the national energy system. 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. Bioenergy can play a role in balancing the grid through a wide range of technical options, including:

- Biogas upgraded to biomethane - International demand for gas exports from eastern Australia is continuing to put pressure on local fossil-based gas supply and prices. Locally produced biomethane can be injected into the local distribution network to improve domestic supply whilst providing net zero carbon energy for gas consumers, hard to decarbonise industrial processes, heavy transport, and gas peaking stations for dispatchable renewable electricity.

- Bioliquids - Liquid biofuels are of interest for grid balancing as they are storable and can be used as required, decoupled from their manufacture.

- Solid biomass - Solid biomass is mostly used in stationary heat and power generation, especially in relation to combined heat and power generation. Solid biomass can be used as co-feed along with other fuels or in boilers capable of firing up to 100% biomass.

More information on the role of bioenergy in supporting the grid is provided [here](#).
Biomass opportunities to enhance Australia’s self-sufficiency and resilience are not limited to fuel, heat, and power. According to KPMG’s “Bioenergy state of the nation report” 2018, the global market for bioproducts is expected to reach over A$1 billion by 2022 as biomass is increasingly utilised in the production of a range of chemical and industrial applications. In Australia, the development of this industry would significantly increase energy supply security.

As an example, due to COVID 19 there has been an unprecedented demand for hand sanitisers and disinfectants. Ethanol is a key component of hand sanitisers (approx. 70-80% of the product) and Australian ethanol producers have pivoted their businesses to increase local supply, keeping our frontline workers safe. This has highlighted how important domestic production and manufacturing is, both now and into the future. If there were no biofuel mandates in NSW and QLD it is highly likely that ethanol would not be produced in Australia at all and we would presently find ourselves in the dire situation of being unable to source this critical product due to global shortages.

In order to maximise domestic opportunities, bioenergy technology should be manufactured onshore, while at the moment it is mostly imported from Europe. This would remove the foreign exchange risk during uncertain times and increase energy security.

Although the Australian bioeconomy should be focused on supporting the domestic market, bioenergy can also represent a significant export opportunity. As an example, biomethane can be exported into overseas markets using existing LNG supply chains. These markets could provide access to higher value environmental attributes (carbon and green certificates) which could underpin a new bioenergy export industry.

**Q.6 > How is bioenergy development in Australia impacted by international and national factors?**

International experience plays a key role in informing the development of the Australian bioenergy industry. Successful mechanisms currently supporting bioenergy industries overseas are presented in Q.15.

In particular, the development of a bioeconomy in Australia is strongly impacted by international and national factors, including ambitious emissions reduction targets, enabling environments, waste management issues and the need to increase energy security and commodity prices.

**Emission reduction targets**

As discussed in Q.3, bioenergy can play a key role in meeting the emission reduction targets and is therefore expected to grow significantly in Australia.

Australia’s Paris Agreement target is 26-28% reduction below 2005 levels by 2030. Sector-specific targets have also been introduced in specific industries, such as marine and aviation (more information in Q.3). 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.

International emission reduction targets are also likely to drive a higher production of low-carbon products currently exported from Australia, including aviation and marine biofuels.

**Enabling environments**
Favourable policy environments overseas are creating competitive distortions to produce biofuels. The advanced policy landscape in California, the UK and Europe has seen an increase in supply in those jurisdictions. Should Australia enact policies that encourage the development of an industry domestically, it will be important to ensure that incentives are in place to encourage competitive pricing with conventional fuels. Without this, producers will export the fuel to markets where they can access subsidies which lead to better economics and therefore greater uptake of fuel.

**Waste management issues**

Australia is facing a waste crisis as landfills prepare for a significant increase in waste directed to landfill in the absence of any strategic alternative. Contributing to the expected jump in landfill waste is also China's "National Sword" waste import ban.

As discussed in Q.1, as landfills reach capacity and waste disposal costs soar, energy from waste (EfW) technologies are expected to play a key role in the Australian waste management system, as they represent an attractive option to turn non-recyclable waste streams into higher-value products.

**Energy security**

The Coronavirus pandemic has highlighted vulnerabilities in Australia’s energy security. This is particularly relevant in manufacturing and in the transport sector. Alarming reports emerge regarding Australia’s low emergency fuel reserves, leaving us vulnerable and creating a critical national security issue. Australia is languishing behind other nations in fuel independence and security and has been named as the least prepared developed nation to deal with such a crisis. Figures produced by the Department of Energy show stockpiles at the end of October 2018 were 27 days total petroleum products, 22 days of petrol and 17 days of diesel. In addition, in 2015 a Senate Inquiry showed Australia was desperately short of its 90-day emergency fuel reserve supplies required as a member of the International Energy Association (IEA).

As discussed in Q.3, bioenergy can play a key role in increasing the national energy security.

**Commodity Prices**

The underlying commodity prices of crude oil and natural gas have direct and indirect impacts on prices realized for bioelectricity, biomethane and biofuels produced in Australia. Consideration should be given to a policy framework that caters for changes in underlying commodity prices. As an example, the US has introduced the Renewable Fuel Standard which establishes a market, via a renewable fuel volume targets for obligated parties (refiners or importers of gasoline or diesel fuel). A penalty serves to create a price for the renewable fuel credits, referred to as RINs, and the penalty amount is a formulaic calculation that is inversely correlated with the underlying price of gasoline. This market mechanism influences a RIN price that increases with decreases in the crude oil prices (and vice versa).

**RESOURCES**

**Q.7 > What are the current uses of feedstocks (especially wastes and residues) in Australia?**

**How will these impact the net potential of that feedstock for bioenergy?**

The bioeconomy is built upon the use of sustainably derived, low-value feedstocks and wastes to produce high-value bioproducts including biofuels, green electricity, biomaterials, biochemicals and bioplastics. The feedstock used for bioenergy-related processes includes agricultural products, organic municipal waste, wastewater, industrial waste, wood waste and animal residues.
Bioenergy Australia supports the diversion of all untreated waste from landfill to encourage resource recovery over the long term. Once the point is reached where no more recyclable materials can be economically or environmentally sustainably extracted from residual waste, we support the recovery of energy as a preferable solution to landfilling for this residual waste. The use of Energy from Waste (EfW) rather than disposal to landfill is a move away from the linear economy and is a key step towards a circular economy approach of converting residual waste into high-value products.

In particular, the disposal of organic, agricultural and forestry residues currently represents an economic and environmental cost, which can be avoided by turning these waste streams into valuable products. When organic waste is treated in an anaerobic digestor, it produces not only biogas, but also a by-product called digestate, which can be recovered and used as a bio-fertiliser. Organic fertilisers have the potential to transform Australia’s agricultural sector, offering an attractive alternative to commonly used mineral fertilisers.

Wood residues and agricultural by-products such as straw can be used to produce pellets. Pellets may be used to supply export markets, or they may be used to produce much needed dispatchable power in Australia as we gradually transition from coal-fired generation. Production of pellets provides long-term jobs, as the production and supply of biomass to processing facilities takes place all year round. There are substantial volumes of biomass currently under-utilised which would be suitable feedstock for pellet production. As explained in the IEA Bioenergy fact sheets “Forests, bioenergy and climate change mitigation: are the worries justified?” and “Is energy from woody biomass positive for the climate?”, energy from woody biomass can be very positive for the climate, particularly when applying sustainable forest management practices and when the biomass is used efficiently. This concept is further discussed in the IPCC special report on climate change and land, which highlights that sustainable forest management can prevent deforestation, maintain and enhance carbon sinks and can contribute towards GHG emissions-reduction goals, while generating socio-economic benefits and providing fibre, timber and biomass to meet society’s growing needs.

With a technologically advanced agricultural sector, a nimble and resilient agricultural community, and a large amount of biomass available as feedstock, the bioeconomy represents a significant jobs and economic growth opportunity, especially for regional Australia.

**Q.8 > Which energy crops have the greatest potential in Australia?**

The major feedstocks for bioenergy are crop and forestry residues, processing residues and wastes, and purpose-grown crops.5

Organic residues from livestock production, agro-processing, timber-milling, construction and demolition, as well as food waste, urban green waste and biosolids are all potential feedstocks for bioenergy, and their use provides sustainability benefits and supports the circular economy.

There is also much potential to produce bioenergy feedstocks from purpose-grown crops. This includes sugar, starch and oil crops and also lignocellulosic crops such as fast-growing Acacias, mallees and other Eucalypt species that can be harvested and ideally naturally regrown (coppiced) on a short-rotation basis. There is also the opportunity to produce Miscanthus (Silver Grass) crops that have been proven as an energy crop in other parts of the world. One of our members is working in Gippsland with the aim to trial this for use in renewable fuels.

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There are large tracts of undeveloped, productive agricultural lands in the NT and WA and we envisage potential opportunity to create energy crops in these regions. Such development could establish critical regional infrastructure and support new agriculture hubs that would service the agri-business, including food and energy sectors.

**Q.9 > What are the potential environmental impacts and/or benefits (such as soil nutrients) of using a feedstock for bioenergy?**

Sustainably sourced biomass can reduce net greenhouse gas emissions: the carbon released on combustion is taken up as the plants are regrown under sustainable management systems. Supply chain emissions are included to quantify the carbon footprint of biomass supply, but these are generally small. Strategic deployment of bioenergy supports a transition to a low-carbon economy through a reduction in greenhouse gas emissions and results in a range of positive environmental and social impacts by alleviating demand for petroleum-based products. Decarbonisation opportunities in different sectors have been discussed in Q.1.

In addition, some bioenergy technologies offer further benefits to the environment. As an example, the by-products of anaerobic digestion (AD) can be utilised as organic fertiliser to improve the soil quality. Digestate is an excellent fertiliser containing nutrients and micronutrients necessary for plant growth. Since no nutrients are lost during AD, farmers can close the nutrient cycle and reuse these vital fertiliser components. Additionally, organic matter in digestate can build up the humus content in the soil; this is a benefit unique to organic fertilisers which is particularly crucial for arid and semi-arid lands with low carbon content. The slow-release nature of this amendment reduces environmental impacts caused by leaching, runoff, and volatilisation. More information on the use and benefits of digestate can be found [here](#).

**Q.10 > Can these feedstocks be expanded sustainably, given land availability, water requirements and other environmental considerations?**

Currently only a small proportion of crop residues are harvested for bioenergy or other purposes. Thus, this is a large potential resource that it currently underutilized. There are sustainability risks associated with removal of crop residues that would otherwise be retained on-site, providing mulch to conserve water, reduce soil erosion and add carbon and nutrients to the soil. Retaining 1-1.5 t dry matter per ha has been recommended to provide soil protection if residues are harvested. Similarly, forest harvest residues from plantations and managed native forests could be used beneficially for bioenergy. It is preferable to retain leaf and bark material on-site, as these have a significant role in maintaining nutrient levels; also, large, hollow logs should be left in the forest to provide habitat. Also, ash can be returned to the forest to replace nutrients removed, if residues are used in combustion applications. In addition, diverting organic residues from landfill avoids methane release and co-products of energy conversion (such as digestate from anaerobic digestion and biochar from pyrolysis) provide high-value soil amendments that enable return of nutrients to farmland.

Finally, there are a number of purpose-grown crops suitable for bioenergy, including sugar, starch and oil crops and also lignocellulosic crops including mallees that can be grown on a short-rotation basis. The latter can be planted strategically, integrated with agricultural enterprises, to provide windbreaks, reduce saline water tables and improve soil nutrition in the case of Acacia species; planted on marginal land where cropping is not viable and used in mine site rehabilitation. Use of native species such as
mallees enhances biodiversity and results in carbon sequestration. Miscanthus is similar where it can be planted in marginal or contaminated land and has the benefit of regenerating the soils in areas it is grown. Energy crops can be a viable new crop, providing income diversity for landholders to supply bio-hubs that support regional development.

**Q.11 > How will climate change impact the future potential of a feedstock?**

Climate change induced increased temperatures and atmospheric CO₂ levels may have a small positive effect on biomass production, particularly in southern Australia. The key determinant of biomass production is rainfall, and the effect of climate change on rainfall is uncertain and varied. Models suggest that it is likely that rainfall, particularly in the growing season, will decrease in the southern cropping regions, while no change or small increases are suggested in the northern cropping regions. The impacts on rainfall in the northern monsoonal regions are particularly uncertain. There is strong agreement, however, that climate change is leading to more variability and more extreme weather events, such as drought, floods, and storms. Therefore, it is possible that availability of crop and forestry residues will decrease under high-emissions scenarios. On the other hand, energy crops, especially short-rotation woody crops, will become an increasingly attractive option, being more resilient to a variable climate than annual crops.

**PUBLIC POLICY**

**Q.12 > What are the impacts of Australia’s current policy mix on the development of bioenergy in Australia?**

While the Federal Government has implemented mechanisms, such as the Renewable Energy Target and Emissions Reduction Fund, to reduce greenhouse gas emissions, it has not had a substantive impact on the development of the bioenergy industry. Policy is needed to incentivise or reward uptake or participation in bioenergy.

The Renewable Energy Target has had the impact of directing all biogas currently being produced into electricity generation, rather than being seen as a key opportunity to decarbonise the gas network. Similarly, the RET encourages use of woody residues for electricity generation rather than for heat, which would offer greater mitigation in some circumstances. State regulators are also limiting bioenergy opportunities in some cases. As an example, biogas projects are often required to meet gas quality specifications more strictly than those relying on other supply sources, impeding biogas uptake.

Notwithstanding, various programs administered by federal agencies, such as the Australian Renewable Energy Agency (ARENA) and Clean Energy Finance Corporation (CEFC), have supported bioenergy projects. They were established to facilitate increased flows of finance into clean, renewable and low emission technologies and they have made a significant contribution to the dialogue relating to supporting policy mechanisms that would assist bioenergy.

Finally, major support is currently given to commercialisation-ready projects, but a high level of assistance is also required for early-stage projects. On this note, Bioenergy Australia has prepared a list of shovel ready projects that can be quickly deployed under the right conditions.
**Q.13 > Are there examples of successful State/Territory-level policy initiatives?**

The following successful policy initiatives are currently operating at State/Territory level.

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<th>State/Territory</th>
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| **Queensland**  | • The Planning Act 2016 and Waste Reduction and Recycling Act 2011 have been implemented by the Queensland Government to support waste management and recovery and ecological sustainability of agricultural areas.  
• The Queensland Government partnered with agricultural and waste industry leaders to develop the 10-year Biofutures Roadmap and Biofutures Program. The QLD Biofuel Mandate has been implemented to achieve the objectives of the above and target $1 billion of investment.  
• Funding of almost $20 million over three years has been approved to implement Queensland’s Biofutures plan including:  
  – Industry Development Fund - $5 million fund offering an interest free source of repayable risk capital to help well-advanced large-scale projects  
  – Commercialisation Program - provides grants ranging from $250,000 to $1,000,000 for pilot-scale and demonstration projects  
  – Acceleration Program - aims to attract and support the development of new or the expansion commercial-scale bio-refinery projects in Queensland.  
• The Queensland government has committed $100m over three years to the Resource Recovery Industry Development Program. A key objective of the fund is to grow Queensland’s biofutures and resource recovery industries and attract investment in new infrastructure. |
| **New South Wales** | In NSW there are significant policies and initiatives where sustainable bioenergy systems can be utilised to deliver site-specific and industry outcomes including:  
  1. NSW Circular Economy Policy  
  2. Energy from Waste Policy  
  3. NSW Climate Change policy  
  4. NSW Decarbonisation Innovation Study  
  5. NSW Special Activation Precincts  
  6. NSW Net Zero Plan  
  7. Clean Energy Initiatives  
More information regarding supporting mechanisms are provided below:  
• Protection of the Environment Operations Act 1997 and the Waste Avoidance and Resource Recovery Act 2001 are defined policies with objectives that are aligned to support the development of the bioenergy industry.  
• The Environmental Planning and Assessment Amendment Act 2017, the State Environmental Planning Policy (State and Regional Development) 2011 and the |
State Environment Planning Policy (Infrastructure) 2007 do not specifically align with the bioenergy sector but offer some support to industry needs.

- The Office of Environment & Heritage (OEH, now within the Department of Planning, Industry & the Environment) introduced The Climate Change Fund in 2007 under the Energy and Utilities Administration Act 1987 which encourages energy and water saving activities and contributes to over 28 grant and research & development programs; some of which directly support the application of biomass production for bioenergy. The grants aim to contribute over $80 million in funding.

- In 2007, NSW introduced the first biofuels mandate in Australia, which required fuel wholesalers to ensure that ethanol made up a minimum of 2 per cent of petrol sold in NSW. As of 2017, the mandate has been re-focused towards ‘volume fuel retailers’ – a service station which sells three or more types of petrol or diesel and sells in excess of 900,000 litres per quarter of petrol and diesel combined, in two consecutive quarters.

Additional NSW bioenergy-related initiatives include:

- Leading the NSW component of the Australian Biomass for Bioenergy project. This program will undertake a comprehensive biomass for bioenergy assessment to uncover new opportunities and make it easier to develop biomass generation and bioenergy projects in Australia. The program is carried out by the Rural Industries Research & Development Corporation (called AgriFutures Australia) with $3 million in funding support from ARENA.

- Investigating opportunities for increased use of biomass for electricity generation under the Primary Industries Climate Change Research Strategy. This includes techno-economic assessments of increased rates of biomass co-firing in coal-fired power stations and hybrid solar/biomass options. The Strategy is made up of seven projects across the three key theme areas to deliver benefits and opportunities to primary producers and regional communities.

- Providing support for ARENA investment in various bioenergy-related projects in NSW focussed on areas including: better utilisation of wood waste; development of ‘advanced drop-in fuels’ (i.e. fuel from non-edible parts of plants); anaerobic digestion (burning of gas from effluent and organic waste at abattoirs) and knowledge transfer (from the international developments in bioenergy).

- Supporting the development of advanced biofuels, including an investment of $4.6 million funded from the NSW Government’s Growing Local Economies fund, which supports projects of economic significance that will deliver new regional economic opportunities.

- Special Activation Precincts, which represent a unique opportunity for regional NSW to demonstrate the value proposition of bioenergy. The Precincts provide a coordinated framework to allow for the facilitation and development of bioenergy projects and systems, along with fostering innovation and technologies. Special Activation Precincts are ‘shovel ready’ enterprise hubs where bioenergy projects can thrive. The Precincts set a clear direction for sustainability and circular
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| • The Victorian Waste and Resource Recovery Policy under the Environment Protection Act 1970 provides a guideline which outlines all the processes and technologies that recover energy or fuel from biological processing and details well-defined policy objectives.  
  > Guideline 1559.1 outlines how the Environment Protection Act 1970 and associated policies and Regulations are applied to the assessment of proposals that recover energy from waste.  
• The Environmental Protection Agency (EPA) Victoria released the siting, design, operation, and rehabilitation of landfill guidelines to provide a clear statement of performance and objectives which are aligned to support the development of the bioenergy industry.  
• In support of the above-mentioned policies and guidelines, the Victorian Government also established the $500 million Sustainability Fund which receives funds from Victorian landfill levies and redistributes as grants.  
• The Waste to Energy Infrastructure Fund directly supports investment in waste to energy technologies that support the state’s transition to a low carbon economy and the creation of full-time employment.  
• The Climate Change Act 2017 drives Victoria’s transition to a net zero emissions state, which provides general support to the development of the bioenergy industry.  
• The New Energy Technology Sector Strategy sets out the need to implement an industry development plan for the bioenergy sector.  
• “Recycling Victoria: A new economy” is the Victorian Government’s 10-year circular economy policy, encouraging appropriate investment in waste to energy infrastructure, including facilities that use organic waste via bioenergy or provide precinct-scale energy.  
  > As part of a comprehensive industry and infrastructure development package, the Victorian Government will support early entrants into Victoria’s waste to energy market, including facilities that use organic waste to make bioenergy or provide precinct-scale energy.  
• The Victorian Energy Upgrades, Project Based Activities scheme incentivises fuel-switching from fossil-based, thermal energy to biomass-based, renewable...
thermal energy. For every tonne of verified greenhouse gas emissions abatement, a certificate the value of which varies based on market supply and demand, is assigned to the project. This is the only renewable heat program in Australia.

| South Australia | • The SA government has funded their own Bioenergy Roadmap to provide a foundation of research and help businesses and industry groups to identify and develop bioenergy projects in SA.
  
  • The SA Energy Plan directly supports the $150 million Regional Growth Fund, which has a focus on enhancing regional infrastructure (inclusive of waste-to-power plants) and the $150 million Renewable Technology Fund which aims to catalyse private investment to support further integration of bioenergy technologies.
  
  • In March 2015, Renewables SA commissioned Jacobs Group (Australia) to analyse South Australia’s bioenergy potential in a step towards creating a sustainable bioenergy industry. |

| Western Australia | • In 2007, the Western Australian Government created a BioFuels taskforce to examine Biofuel opportunities. The taskforce made 22 recommendations, but due to a change in government priorities, none appear to have been implemented.
  
  • In 2014, a Biomass scoping study - Bulletin 4862 was published by the Department of Agriculture and Food which also outline Bioenergy opportunities. There is no update on whether any findings have been implemented.
  
  • Bioenergy projects can apply for funding support through the State Government’s Collie Futures Fund and Clean Energy Future Fund. |

| Australian Capital Territory | • The ACT Waste Management Strategy 2011–2025 sets objectives for achieving no waste to landfill and was a result of community consultation. The strategy also supports the potential of innovative bioenergy technologies.
  
  • The ACT Sustainable Energy Policy highlights the ACT Government’s goal to reach 100 per cent renewable generation by 2020, although does not explicitly outline objectives to drive the development of the bioenergy sector.
  
  • The Electricity Feed-in-Tariff (Large-scale Renewable Energy Generation) Act 2011 provides a mechanism to stimulate investment in large-scale renewable energy in the ACT, however, it has not directly aligned with the bioenergy sector.
  
  • After consultations with the communities and industries, the ACT Waste-to-Energy policy 2020-2025 was introduced. An important element of this policy is that it respects the waste hierarchy, and waste reduction, reuse and recycling of materials will take precedence over energy recovery applications. Thermal treatment of waste including incineration, gasification and pyrolysis will not be permitted in the ACT other than for existing plants which can continue operation. Non thermal means of energy recovery such as anaerobic digestion, or the production of refuse derived fuel (RDF) will be allowed. In addition, where waste-to-energy activities are permitted in the ACT, only residual waste will be eligible as a fuel. |
Tasmania

• The Tasmania Energy Strategy was released in 2015 and included $200,000 funding for biofuels, $550,000 in funding for forest residues and $1.25 million in funding for Wood and Fibre processing. The energy strategy is under revision and is expected to support bioenergy more strongly.

• In its 2017 report, the Tasmanian Energy Security Taskforce, a committee implemented under the Energy Co-Ordination and Planning Act 1995, deemed bioenergy (biomass) technology too costly in the short-term. However, given more government support it may be viable in the long term.

• In 2018 the Tasmanian Wood Encouragement Policy was introduced to incentivise the generation of bioenergy from forestry residues. The policy seeks to ensure wood is considered in the design of government buildings including biomass heating and associated energy production.

• In the Sustainable Agri-Food Plan 2019-23, the Tasmanian Government has set out a detailed strategy for helping achieve the AgriVision 2050 goal of increasing the value of the Tasmanian agricultural sector to $10 billion per year by 2050. The Growing Tasmanian Agriculture Research, Development and Extension for 2050 White Paper outlines investment in sustainable growth and productivity of Tasmanian agriculture and food sectors. A circular economy model has been identified as emerging priority and the bioeconomy sits under this priority.

• Energy from Waste and bioenergy options are supported in the draft Waste Action Plan 2019.

• Bioenergy forms part of the Climate Action Plan 21, which highlights that “Tasmania’s well-established forestry industry, together with agricultural production, has an opportunity to use residue materials for biomass, including biofuel and bioenergy, which can reduce emissions from the State’s transport and energy sectors. Bioenergy is a mature energy generation technology in Europe and its development in Tasmania provides an opportunity for jobs growth in regional areas as well as reducing the use of fossil fuels.”

• The Tasmanian Renewable Energy Action Plan 2020 notes that the Tasmanian Government is developing options to support the bioenergy sector.

Q.14 > What policy and regulatory instruments could further support the development of bioenergy in Australia?

A key opportunity to support the development of bioenergy in Australia would be to develop a national Clean Futures Target and market-based Bio Industries Fund for Australia. These two powerful initiatives are proposed to achieve job creation and economic growth, particularly in regional areas; increase Australia’s self-sufficiency by strengthening the energy sector and support local industry and manufacturing; reduce Australia’s waste and support the conversion of waste into valued products; and achieve a significant reduction in greenhouse gas emissions. The bioenergy sector, though proportionally small, has significant potential for sustained and sustainable growth.
Australia's Clean Futures Target

A Clean Futures Target would embody the opportunity for decarbonisation of the national transport, gas and heat sectors. Such a program would deploy a similar approach to the Renewable Energy Target which was highly successful in supporting decarbonisation of the electricity sector. The proposal would be to implement:

1. A Clean Fuels Target with a 10% reduction in transport related GHG emissions relative to 2020 levels by 2030, with individual annual and fuel type targets to be set after appropriate modelling. The target should be supported by incentives for sustainable fuels.

Reference program: Low Carbon Fuel Standard (LCFS). Since 2011 the LCFS in California has helped drive over US$1.6 billion in investment in California’s clean fuel economy.

2. A Renewable Heat Target. The Large-Scale Renewable Energy Target (LRET) has only recognised the renewable energy benefits from electrical energy (such as the replacement of coal with renewable biomass feedstocks used to produce electricity). A significant renewable energy opportunity is currently being missed, and this recommendation is that the use of renewable biomass should similarly extend to the generation of heat energy (e.g. process steam for drying in papermaking or sawmills). Inclusion of renewable heat in the RET (or any alternative carbon policy mechanism) has significant potential and could contribute the equivalent of several thousand GWh in renewable energy per annum from the wood and paper products industry in Australia.

Reference program: Renewable Heat Incentive (RHI). The UK government aimed for 12% of UK homes to be renewably heated by 2020 and current trajectories suggest it will reach 8-10%. The UK Committee on Climate Change has suggested that the UK would require 15 million homes to be fitted with heat pumps or hybrid heat pumps by 2035.

3. A Green Gas Target. A comparison of renewable gas with renewable electricity incentives shows that there are key elements missing for encouraging a transition to renewable gas, such as a national target that will drive investment and mechanisms that allow renewable gas project developers to participate in Australia’s renewable energy markets. To raise Australia’s policy development for renewable gas up to international standards, this recommendation is that the Government consider establishing a near-term aspirational target for cost-effective renewable gas injection into the gas networks by 2030. The target should be informed by a cost-benefit analysis that looks at the use of renewable gas to decarbonise the gas network.

Reference: Denmark has a target to supply the gas grid with 100% green gas by 2035.

4. Net Zero Organic-to-Landfill Target. In accordance with the waste hierarchy, waste should be recovered for its highest order use wherever it is economically feasible to do so. Therefore, instead of being disposed to landfill, this recommendation is for organic waste to be collected and converted into higher-value products, such as biogas or biomethane, pyrolysis gas and biochar. This target would significantly contribute to the national transition to a more circular economy, as discussed in the IEA report “Anaerobic Digestion of Food Waste for a Circular Economy”, by supporting industry’s energy needs, co-producing valuable organic fertilisers for farmlands and capturing precious water through land application of digestate. In addition, the injection of biomethane into the gas network would decarbonise the gas supply for households. This recommendation therefore proposes to introduce a target for the complete diversion of organic waste from landfill. The target should be supported by a landfill ban on organic waste. E.g. in Finland, a ban on diverting organic waste to landfill came into effect in 2016. Belgium, Denmark, Netherlands, and Switzerland have achieved “zero waste to landfill”
with only 1% of municipal waste going to landfill with development and integration of organics processing and energy from waste infrastructure.

Some Australian States and Territories are also working on a similar target. As an example, the NSW Government’s Net Zero Plan Stage One: 2020-2030 seeks to achieve net zero emissions from organic waste in landfill by 2030.

5. ERF/CSF Jobs Target: There is the potential to make minor amendments to the existing and already funded ERF/CSF program to unlock many bioenergy and circular economy projects and jobs.

• Up Front payment of carbon revenue: currently payment of carbon revenue is spread over 7-10 years. This current rule has the potential to stall development of new bioenergy technologies, so we would like to see the carbon offset attributes of the project valued over the project life. For high capex projects (such as bioenergy and circular economy projects), a zero-cost amendment to this, that would unlock bioenergy projects, would be to allow payment of ERF payments upfront to contribute to project capex (rather than over 7-10 years). This could be discounted sufficiently at no additional cost to Government (e.g. 80% of the total value if deemed day 1), could be capped at 50% of project cost and be backed by delivery guarantees.

• Co-benefit Multiplier: For projects which generate other significant benefits, such as circular economy outcomes, jobs and provision of lower cost renewable heat to underpin Australian manufacturing operations, a multiplier could be applied to carbon revenue generated to allow for increased payments and therefore accelerate projects. The use of multipliers in certificate-based policies has precedent overseas.

• Technology categories: CSF auctions could be undertaken in categories, with higher proportion of ACCUs purchased in categories that achieve additional benefits, such as circular economy, jobs and renewable heat.

• The National Greenhouse and Energy Reporting scheme (NGERs) Act should be amended to allow reporting entities to reduce reportable emissions if they use biomethane purchased from a multi-user natural gas network. Currently, the NGERs does not recognise that gas, delivered from a multi-user has network and derived from the supply of biomethane, is a source of energy with net zero carbon emissions. We believe this is an impediment to the growing biomethane market and the creation of new carbon offset methodologies.

• New ERF Methods should be developed to support new carbon offsets projects that are derived from bioenergy. An eligible offset project is the mechanism that enables new ERF Methods to create Australian Carbon Credit Units (ACCUs).

Australian Bio Industries Fund

In addition to the Clean Futures Target, the Bio Industries Fund would align to the outcomes of the Federal Government Bioenergy Roadmap and would ensure that projects can progress immediately. There are a range of ways the fund could be created and delivered, and we would welcome the opportunity to discuss this further with the Government. The Australian Bio Industries Fund would provide opportunities for support across the following:

1. Upgrading existing facilities to increase productivity, reduce costs or emerge into new industries. Existing bioenergy projects in Australia have an opportunity to upgrade their infrastructure to implement new and emerging technologies. This recommendation is
anticipated to result in expanded feedstock processing, increased and enhanced outputs and increased efficiencies resulting in reduced emissions and running costs, increased employment and new product applications.

As an example, glycerol (also known as glycerine) is a major by-product in the biodiesel manufacturing process. There are various outlets for utilisation of the crude glycerol generated by biodiesel plants. For example, it can be refined into a pure form for use in food, pharmaceutical and cosmetics industries. Given its moisturising properties, glycerol plays a key role in the production of hand sanitisers, and global supply is currently not meeting demand. This recommendation would enable Australian biodiesel refiners to expand their current refineries to produce this valuable product and recreate a domestic industry in Australia, supporting both local jobs and local production.

Another example would be the support of a current producer of biomethane to connect into the existing national gas infrastructure network.

2. **Undertake feasibility assessments for converting low-value residues into new energy products under a circular economy approach.** Feasibility analysis is an important method of exploring the commerciality of new opportunities to extract value from end-of-life residues. Consider the example of the hardwood residue bio-refinery feasibility study completed by Boral Timber. The study, supported by ARENA, explored the technical and financial viability of building a second-generation hardwood residue bio-refinery to convert this residue into renewable liquid fuels. The hardwood residue bio-refinery feasibility project also explored the potential regulatory hurdles to developing bio-refineries in rural New South Wales. The study found that sawmill and forest residues account for a major under-utilised resource in the hardwood industry.

3. **Undertake new project development of replicable low cost, high value projects such as anaerobic digestors for local councils, food and agriculture processing facilities and wastewater treatment.** This recommendation is modelled on the Bioenergy Roadmap Program funded by the South Australian Government. The Program is envisaged to enable businesses and industry groups to identify and develop commercially ready bioenergy projects. Blue Lake Milling was one of the first companies in South Australia to take advantage of the Program and is consequently now able to convert oat husks into biomethane that generates power for the mill, with the remainder injected into the State’s grid. This recommendation is for a similar program to be delivered at national level as part of the Green Futures Fund.

In addition to our main policy recommendation, we also propose additional ways the Government can support the development of bioenergy in Australia.

1. **Mandate a portion of clean fuels across fleet and procurement contracts for the Federal Government**
   - Government role: Policy development
   - Industry readiness to act: Immediate
   - Jobs created: Supports the 10,000 + jobs created by the Clean Fuels Target.

This proposal is to introduce a sustainable fuel requirement across all transport sectors for the Australian Defence Force and Government Fleet, as well as for all Government awarded
tenders for the works performed under the contract (e.g. roads upgrades, rail infrastructure, bridges, etc.). Reference program: Great Green Fleet. As an initiative of the US Federal government, the US Dept of the Navy developed a scheme to establish the Great Green Fleet in 2016. The program was created to provide the US Navy with half of its fuel and power from clean, fossil-alternative sources by 2020, with biofuels as a significant portion of the alternative fuel mix.

2. **Excise reduction support extended to renewable diesel, BioCNG and BioLNG and incentives to produce SAFs**
   - Government role: Policy development & tax modification
   - Industry readiness to act: Immediate
   - Jobs created: Supports the 10,000 + jobs created by the Clean Fuels Target.

   We propose an excise reduction for renewable diesel and bio compressed natural gas (BioCNG) and bio liquefied natural gas (BioLNG). This would require an update to the existing tax schemes to support new and developing renewable fuels in Australia by levelling the playing field with existing renewable fuels. Renewable diesel, BioCNG and BioLNG are fuels that will have a significant impact in sectors such as marine, and provide a substantial opportunity for job creation and regional growth in Australia. Reference program: the proposed excise reduction would operate in a similar fashion to the Ethanol Production Grants Program and the Cleaner Fuel Grants Scheme, which provide a full excise rebate on ethanol and biodiesel produced in or imported into Australia. Similar incentives should be introduced to produce sustainable aviation fuels.

   Excise support for renewable fuels would strongly encourage the domestic utilisation of resources currently intended for the export market, such as wood chips. This would support a circular economy in Australia and provide a greater net economic gain, as well as jobs, than the current export market can provide.

3. **Provide funding for the development of the Clean Fuels Challenge & Clean Fuels Network**
   - Government role: Direct funding (up to $300,000)
   - Industry readiness to act: Immediate
   - Jobs created: Supports the 10,000 + jobs created by the Clean Fuels Target.

   With the world transitioning to lower emission vehicles, Australia is also required to take steps to ensure compliance with new standards, cost savings for motorists from more fuel-efficient vehicles and health benefits to the community from cleaner air. Due to their low sulphur and aromatic content, biofuels offer a sustainable, low-carbon alternative and, when blended with low PPM sulphur fuel, are the perfect solution for Euro 6 emission vehicles. The Clean Fuels Challenge and Network proposes to identify outlets selling fuel that is Euro 6-compliant, to recognise significant fuel users who commit to cleaner fuels and to support the development of the local biofuels industry, resulting not only in a lower level of emissions from the transport sector but also in an enhanced national fuel security.

4. **Develop a renewable gas certification system**
   - Government role: policy development
   - Industry readiness to act: Immediate
   - Jobs created: Supports the creation of 1000 new jobs.
This proposal is that each GJ of biomethane injected to the grid is labelled electronically with a unique identifier (certificate) containing information describing where, when and how the biomethane was produced. When consumers buy green gas, the certificate is their guarantee that the renewable claim to the gas is of standardised quality and manufactured in Australia. Reference program: certificates from the two British biomethane schemes – Green Gas Certificate Scheme (GGCS) issuing Renewable Gas Guarantees of Origin (RGGOs) and Biomethane Certificate Scheme (BMCS) issuing Biomethane Certificates (BMCs).

5. **Develop a renewable gas injection tariff**
   - Government role: Feed in Tariff
   - Industry readiness to act: Immediate
   - Jobs created: Supports the 10,000 + jobs created by the Clean Fuels Target.

This proposal is to introduce feed-in-tariffs (FiTs) to provide biogas producers with a purchase guarantee at a fixed price for 20 years. Reference program: in 2013, the Italian Government re-oriented its biogas policy from electricity generation (except for small plants) to biomethane production and it set up a FiT for biomethane production for natural gas vehicles, high-efficiency co-generation and grid injection.

6. **Implementation of a ‘gas swap’ model for biomethane and natural gas**
   - Government role: policy development
   - Industry readiness to act: Immediate
   - Jobs created: Supports the 10,000 + jobs created by the Clean Fuels Target.

This proposal is to introduce a gas swap model to the natural gas sector. This would allow natural gas consumers to receive the benefits of the green attributes of biomethane supplied and delivered across a multi-user natural gas network. By separating the green attributes of biomethane from the underlying gas commodity, users and suppliers can swap supply of natural gas and biomethane. This reduces biomethane transportation costs and can enable any consumer on a gas network to purchase biomethane to reduce carbon emissions and use renewable fuel. It will increase market size, allowing consumers to access remotely supplied biomethane. This model has been successful in many overseas markets, highlighting its effectiveness in expanding the market for biomethane and consolidating supply and demand. More information about the gas swap model can be found [here](#).

Finally, bioenergy is multi-faceted, and Bioenergy Australia highlights the need to have a dedicated portfolio looking at developing the national bioeconomy to ensure consistency in approach between states, local and federal governments.

**Q.15 > What lessons could be taken from overseas to inform Australia’s bioenergy policies?**

International bioenergy projects and policies demonstrate the bioenergy opportunities available for Australia if development of the industry is actively supported by the Federal and state and territory governments. The key significant difference in countries with a strong bioeconomy is the political leadership and whole of government approach given to the bioeconomy. Some specific examples are highlighted in the table below (Source: [Bioenergy state of the nation report](#), 2018).

<table>
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<tr>
<th>Project</th>
<th>In-country policies</th>
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28
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<tr>
<th>Finland</th>
<th>United Kingdom</th>
<th>Switzerland</th>
<th>USA</th>
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| The City of Helsinki in Finland has a vision to become carbon neutral by 2050. One innovative element of the city’s strategy is the Katri Vala integrated heating and cooling plant. The plant operates the world’s largest heat pump system based on heat from purified sewage and sea water. | • Renewable energy target of 38 per cent by 2020.  
• Feed-in premium of 60 per cent for electricity from wind, biogas, and forest residues.  
• Investment support for high risk projects.  
• Carbon tax for fossil fuels in heating.  
• Landfill ban for organic waste. | • Renewable energy target of 24 per cent by 2020.  
• Feed-in remuneration scheme, covering difference between production and market price.  
• Carbon tax on fuels for stationary applications.  
• Phase-out plan for nuclear power through promotion of renewable measures.  
• Target to recycle 50 per cent of Municipal Solid Waste. |
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• Feed-in premium of 60 per cent for electricity from wind, biogas, and forest residues.  
• Investment support for high risk projects.  
• Carbon tax for fossil fuels in heating.  
• Landfill ban for organic waste. | • Renewable energy target of 15 per cent by 2020.  
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year of renewable syncrude. Off-takers include United Airlines, Air BP and Cathay Pacific.

<table>
<thead>
<tr>
<th>Sweden</th>
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<tr>
<td>Under their new sustainability program, Danish-owned Carlsberg Group</td>
<td>• Renewable energy target of 50.2 per cent by 2020.</td>
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<tr>
<td>aims to eliminate all carbon emissions from their breweries. In doing</td>
<td>• Declaration of a fossil independent vehicle fleet by 2030.</td>
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<tr>
<td>so, the Group’s brewery in Falkenberg, Sweden is now 100 per cent</td>
<td>• Carbon taxing predominately on heating and service sectors.</td>
</tr>
<tr>
<td>fuelled by biogas and green electricity which reduces their carbon</td>
<td>• Landfill ban for organic waste.</td>
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<tr>
<td>emissions from thermal energy to zero.</td>
<td>• Electricity certificates to increase renewable electricity usage.</td>
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In addition to the case studies presented in the table, a few key mechanisms currently supporting the bioeconomy in USA are listed below:

- A federally supported RFS will deliver 32 billion gallons of renewable fuel
- State based schemes operate alongside federal scheme with projects capable of being supported by both schemes
- The gas swap model has facilitated the rapid uptake of biomethane projects which deliver CNG and LNG into the transportation market. Without this, projects across the country could not consolidate supply and develop the supply scale needed to support investment in CNG and LNG infrastructure
- The use of a target with a penalty price that is inversely correlated to oil prices has helped mitigate commodity price risk
- Long-term target volumes remain uncertain, and this has inhibited the development of a secondary market where long-term price contracts for bioenergy can be created

More information on other policies can be found in the IAEA Bioenergy Countries’ Report – Update 2018 Bioenergy policies and status of implementation.

**SOCIAL LICENCE**

**Q.16 > What factors (such as shared economic benefits, safety and environmental impacts) will drive social acceptance and broad public support of bioenergy in Australia?**

Local energy needs, environmental impacts, benefits to community from bioenergy companies, level of trust on company and relationship between company and the community are some of the prime factors which influence community’s perception on bioenergy projects.

In addition, we believe that the following factors could drive social acceptance and broad public support of bioenergy in Australia:

- Industry Accreditation
- Higher level of expertise to increase amount of credible information available to make decisions
- Confidence in existing state regulation related to air and water emissions
- Improved WHS Accreditation system

The work undertaken by the Gas Industry Social and Environmental Research Alliance (GISERA) is a good example of how to address social licence concerns.

**Q.17 > What are the conditions for maximising social licence for bioenergy development at national, regional and project levels?**

Bioenergy Australia has identified the following critical conditions for maximising social license for bioenergy development:

- Land and feedstocks are used in ways that minimise waste and meet community expectations
- Perceived benefits outweigh perceived costs
- There is ongoing engagement and education from very early in project conception
- Negative impacts from transport of feedstocks must be minimised
- Governance and regulation enable community involvement

**Q.18 > What are the forms of bioenergy that are most likely to be supported?**

The general public is relatively unfamiliar with bioenergy, which in part explains the lack or lukewarm support of bioenergy. To date, the preference for the biomass source is seen to be tightly coupled to how its use impacts the food supply, the environment and the potential depletion of natural resources. That said, the technologically diverse nature of the bioenergy industry leads to social license for the industry as a whole being difficult to secure. Rather than identifying specific technologies for their social license potential, it may be more practical to first consider the characteristics of a technology which impact social license. Looking to the 2017 ARENA funded IPSOS report into social license for large scale solar generation (REF), five key main themes were found to be impacting individual perspectives on the technology – Reliability and Efficiency, Visual Impacts, Environmental Impacts, Economic and Employment Impacts and Health Impacts.

These factors are very relevant for bioenergy and what can be seen behind these themes are three core areas of impact: people, environment and economic. Studies identifying which bioenergy technologies optimize the impacts across these key impact areas, as well as the relative importance of the bioenergy relative themes within these key impact areas, are expected to discover which forms of bioenergy are most likely to be supported.

**KEY STAKEHOLDERS**

**Q. 19 > Who are the key bioenergy stakeholders and what is their role in the development of the bioenergy sector in Australia?**
Key bioenergy stakeholders are the industry associations and corporations operating in the sector, including Bioenergy Australia and all Bioenergy Australia members, Energy Networks Australia, Waste Management & Resource Recovery Association of Australia (WMRR), Australia Forest Products Association (AFPA), Australian Pork Limited (APL), Meat and Livestock Australia (MLA), AgriFutures. 

Our role is to secure jobs and investment in the bioenergy sector, maximise the value of local resources, minimise waste and environmental impact and develop and promote Australian bioenergy expertise into international markets.

The Federal and State governments, as well as local councils and energy regulators have a key role in supporting the development of the bioenergy sector in Australia from a policy perspective and through seed funding.

Research institutions, learning centres and universities are also crucial players, as they provide the skills needed for a vibrant bioenergy industry in Australia and contribute valuable research relevant to development and governance of bioenergy, for example relating to technologies, potentials, co-benefits and sustainability aspects.

Finally, key actors in and around the growing bioenergy sector, including associated industries and the communities along each step of the energy value chain, are all stakeholders critical to the social licence of bioenergy as a whole.

Q.20 > What special expertise and insights do various stakeholders bring?

Each organisation can bring specific expertise or support towards the development of a strong bioeconomy. In particular, research bodies, consultants and technology experts are the main sources of technical knowledge; producers secure feedstock; developers are instrumental for project development; investors provide funding; global leaders utilise the international knowledge to boost the national industry; Government representatives can develop policy and mechanisms to support the sector, and community organisations are the real world examples of successful collaboration projects. Industry associations act as the glue between all these categories to ensure a strong and consistent work towards the same aim.

Thank you for the opportunity to provide this submission.

Yours sincerely

[Signature]

Shahana McKenzie, CEO Bioenergy Australia