National Bioenergy Roadmap Submission

The Significant Role for Biochar in Australia

PART 2: Submission Response to ARENA's Specific Queries and Our Recommendations for the National Bioenergy Roadmap

"Successful bioenergy deployment necessitates a cross-sectoral, integrated approach where the efforts of all stakeholders –ranging from energy, agriculture and forestry, infrastructure, environment, technology and innovation, to economic and social affairs –are coordinated into concerted, sustainable action"

International Energy Agency (IEA) and Food and Agriculture Organisation (FAO), (2017)

ANZBI, June 2020

AUSTRALIA NEW ZEALAND BIOCHAR INITIATIVE Inc. ANZBI

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Thank you to all those who contributed to the ANZBI submission and gave up their time and information to assist.

"All pathways that limit global warming to 1.5 °C with limited or no overshoot, project the use of ***carbon dioxide removal (CDR) on the order of 100–1 000 $GtCO_2$ over the 21st century****. CDR would be used to compensate for residual emissions and, in most cases, achieve net negative emissions to return global warming to 1.5 °C following a peak"*

International Panel on Climate Change (IPCC), (2018)

"Biochar may represent the single most important initiative for humanity's environmental future The biochar approach provides a uniquely powerful solution, for it allows us to address food security, the fuel crisis, and the climate problem, and all in an immensely practical manner."

Prof Tim Flannery, 2007 Australian of the Year

Executive Summary

Preamble: *This document forms Part 2 of the Australian New Zealand Biochar Initiative's Submission to the Australian Renewable Energy Agency's National Bioenergy Roadmap. Refer also Part 1 separately.*

The Australian Renewable Energy Agency (ARENA) has been tasked with the development of the national **Bioenergy Roadmap** to identify the role that the bioenergy sector can play in:

- **accelerating Australia's energy transition**,
- **stimulating regional development**,
- **enhancing energy security** and
- **helping Australia further reduce our emissions**.

In addition to responding to ARENA's specific queries for the roadmap, our submission also seeks to inform and update ARENA and the team developing the national Bioenergy Roadmap to:

- Communicate the **globally commercialised status** of the biochar sector within the broader bioenergy industry, as a **scalable and ready Negative Emissions Technology for CO_2 removal**, and its potential in Australia across multiple applications and sectors of our economy;

- Introduce ANZBI and its important work to advance the biochar sector, and inform the government as to the **emergence of a formal industry cluster as the *Australian and New Zealand Biochar Industry Group (ANZBIG)*** which is launching in July 2020***.*** A Business Plan and Funding Program has been developed to support the growth of the sector through the ANZBIG cluster. Consultations with government agencies tasked with supporting the CCUS sector (such as NERA) are commencing accordingly and the organisation welcomes further direct engagement with ARENA, other government agencies, and the teams tasked with development of the national *Bioenergy Roadmap* and broader *Technology Innovation Roadmap*.

Accordingly, this submission by the Australian and New Zealand Biochar Initiative (ANZBI) is comprised of:

- **Part 1:** Introduction to ANZBI, and Why Biochar is Important for the National Bioenergy Roadmap
- **Part 2:** Submission Response to ARENA's Specific Queries and ANZBI Recommendations
- **Supporting Appendices**

It is understood that the ***National Bioenergy Roadmap*** will have a direct relationship with the broader ***Technology Investment Roadmap*** concurrently under development. Negative Emissions Technologies (NETs) including biochar and bio-sequestration have been noted within the discussion paper for the Technology Investment Roadmap, but currently do not yet feature with presence in the supporting documents for the Bioenergy Roadmap to date. Accordingly, ANZBI representatives actively participated in the public workshop for the bioenergy roadmap and would welcome further direct engagement as the roadmap progresses. ANZBI's substantial effort in compiling our submission for the development of the National Bioenergy Roadmap aims to justify biochar and ANZBI/ANZBIG playing an important role in the development of the Bioenergy Roadmap, and in doing so highlight biochar's potential contribution to bioenergy and multiple sectors of the Australian economy, and to employment and regional growth.

Biomass and Biochar

Biochar is a stable, carbon-rich form of charcoal produced by heating organic residues from plants or animal wastes (biomass) in an oxygen limited environment. Biochar is chemically and biologically much more stable than the organic matter from which it was made.

Biochar presents a way to recycle carbon from the atmosphere (where we have too much), back into our soils (where we have too little) to maintain the agricultural productivity we will need in the coming decades, among many other applications and benefits.

Plant biomass consists of approximately 50% carbon, which the plant removes during its lifecycle from the atmosphere in the form of CO_2 via photosynthesis. Plants store carbon into organic molecules such as glucose, cellulose, and lignin. When plant biomass is conventionally burnt or decomposes, the assimilated carbon is released again as CO_2. However, if the plant biomass is pyrolysed, only part of the plant carbon becomes volatile as combustible gas (recoverable ***syngas*** for bioenergy) and/or **bio-oil / wood vinegar**. The other third to half is transformed into a very stable, solid form of carbon (**biochar**) that degrades extremely slowly under natural conditions. Provided that the biochar is not burned, the carbon in the biochar remains in the terrestrial system from 100 to 100,000 years and thus represents a terrestrial carbon sink (European Biochar Certificate, 2020).

Biochar is emerging globally as a valuable carbon commodity:

- Agriculture and Land (including Animal Feed)
- Air & Environmental Management
- The Built Environment
- Water & Wastewater
- Bio-Materials, Advanced Manufacturing/Industrial

*"The **global biochar market** size is estimated to reach **USD $3.1 billion by 2025**" (Grand View Research 2019).*

It is expected to expand at a CAGR of 13.2% over the forecast period.

The biochar industry sector has commercialised and is industrialising rapidly globally led by China, USA, and Europe, with Australia now well positioned to accelerate further with leading technologies, world-best researchers and applications across multiple sectors of the economy.

Current biochar production:

- **China**: **>300,000 (up to 500,000) tonnes per annum and rapidly growing**
- **USA**: ~50,000 tonnes per annum and growing
- **Europe**: >20,000 tonnes per annum and growing

For comparison (and **opportunity for growth**):

- **Australia:** currently **~5,000 tonnes per annum**, and growing

modern PyCCS Systems turn organic residues into Bio-Energy and Biochar

biochar provides long term carbon drawdown and multiple economic and ecological benefits

The science is strong, the technology and economics have improved, it's time to commercialise:

Since the term 'biochar' was coined in the late 1990s[10], thousands of lab and field trials have been performed, with **more than ten thousand published papers and reports,** and **hundreds of thousands of tonnes of biochar have been produced** in both private and government programmes worldwide[11].

Australia has a high potential for low cost carbon drawdown provided by pyrolysis and gasification technologies. Leveraging on the significant research and case studies to bring the Australian industry to this point, larger scale demonstrations and broader awareness of benefits (including with regulators and the broader business community) will help accelerate the industry. Assisted by the national bioenergy roadmap, the nation could (and should) have a large role for biochar and bio-sequestration bioenergy technologies by 2030. These include carbon removal through Pyrogenic Carbon Capture and Storage (PyCCS) and Bioenergy with Carbon Capture Utilisation and Storage (BECCS/BECCU). Accordingly, ANZBI has made a number of recommendations for the National Bioenergy Roadmap (refer **Section 9**).

The biochar industry sector has the potential to contribute significantly to the following:

Economic:

- **Rural and Regional employment**, including substantial multiplier effects in upstream (biomass supply etc) and downstream (markets) industries
- **Assist PostCovid 19 Recovery** – new jobs and green jobs, potential high growth sectors
- **Assist food and energy security**
- **"Turbo-boosts" other sectors** (eg agriculture productivity, drought resilience)
- **Circular economy** (wastes to resources of higher value) – today many recoverable organic residues are burned or landfilled, such as plantation wood residues and crop stubble etc.
- **New Carbon Economy** (Carbontech, biobased materials) – US domestic market potential alone estimated at >$200B per annum for solid carbon products (Carbon 180, 2019).
- **Complementary to other forms of bioenergy** (e.g. can improve gas quality and quantity in Anaerobic Digestion for biogas etc)
- **Complementary to other forms of renewables** (e.g. potential for graphite from biochar for Li Ion battery production, bioenergy for dispatchable energy and potential for cogeneration with solar/wind (allowing 24/7 operations, reducing terms for ROI on those technologies).
- **Opportunity to accelerate through further support:** ARENA has spent over AUD $118M on the bioenergy sector in the last 8 years. Supported projects involving biochar are limited to date (e.g. Logan Biosolids Gasification Project) and as such the sector represents significant potential for further consideration and investment.

Environmental:

- **Critical Action on Climate Change** – significant carbon dioxide removal (drawdown / sequestration), not just cuts to continued emissions. Reduction in even more destructive GHG gases such as N_2O (nitrous oxide) and CH_4 (methane).
- ***Drought resilience*** for farms and also urban vegetated areas (reduced water requirements for soils and sporting fields etc). Biochar absorbs up to several times its weight in water.
- **Sustainable and profitable regenerative agriculture**
- **Circular Economy** and waste minimisation
- **Land remediation and rehabilitation**

Social / Socio-economic:

- **Rural and Regional employment**
- **Mitigation of the 'Brain drain' and 'youth drain' from the bush** toward larger cities, through provision of employment in exciting new green technologies and applications, including many still with direct contact (and benefit for) the land.
- Opportunities for indigeous employment as part of fire stick management and land rehabilitation especially removal of woody weeds

Theoretical Potential For Biomass to Biochar and Bioenergy:

Significant biomass resources are currently being wasted which could potentially be diverted to beneficial biochar and bioenergy. For relative current context, global biochar production capacity (led by China) is ~<1% of the volume of biomass being wasted annually in Australia alone.

- **Up to ~50-100 Million** metric tonnes per year of **residues no longer burned/landfilled**
- **Up to ~15-30 Million** metric tonnes per year of **biochar potentially produced**
  - Biochar saleable economic value **$7.5B-$15 Billion** (@AUD $500/t)
  - Additional carbon credit value (current market value) **$1.5-$3 Billion** (@ AUD$100/t)**
- **>Up to 10-20 Million** metric tonnes/y CO_2e of **CO_2 removal (Negative Emissions/Drawdown)**

  (i.e. equivalent of **up to several % of Australia's 2019 total GHG emissions**)
- **Up to ~50-100 Pj/year** of Biogas (syngas) for national energy security
- **Up to ~50, 000 jobs** (rural and regional focused)

***** Conservative estimate on current markets.*** *Puro Earth CORCs credit value June 2020: Euro €30/t CO_2e (~AUD $48/t CO_2e @ exchange rate 1.6) and typical >3t CO_2e per tonne of biochar,* ➔ *i.e. current credit value June 2020 AUD* ***~$140/t biochar****. For further relative context, the Stripe project in USA recently paid over* ***USD $100/t CO_2e*** *for (non-biochar) voluntary market carbon sink products,* ***nearly triple*** *the conservative estimate above. https://stripe.com/blog/first-negative-emissions-purchases*

Overall, biochar can provide a significant and positive influence on **food and energy security**, **carbon drawdown** (action on climate change), whilst providing a **new range of valuable carbon based products and services** with **multiple environmental and economic co-benefits,** including significant opportunities for rural employment and regional growth.

From small distributed / decentralised systems through to centralised large-scale processing, modular and scalable, many forms of commercial technologies and applications for biochar now exist and are ready to expand.

European, American and Chinese biochar industries have all established biochar production standards to guide the industry and provide regulatory, consumer and producer confidence in biochar quality, and (through ANZBI) the Australian industry has leveraged on these for our own draft Codes of Practice and Standards customised to Australian needs, whilst remaining consistent where practicable. Australia holds some of the finest researchers in the world on the subject (research which should be further supported and leveraged upon) with at least five Australian scientists working in biochar who are in the top 1% of cited scientists in all fields of science globally. We also have some of the world's best new technologies and commercial applications in biochar and associated bioenergy. ANZBI hosts an annual conference (www.anzbc.org.au) to showcase achievements in the sector and its further potential.

Much has been done, there is much more to do. Globally the biochar industry has advanced to industrial readiness. In Australia and New Zealand, ANZBI is about to launch (July 2020) as a formal industry cluster – the Australia New Zealand Biochar Industry Group (ANZBIG) - and has established formal business plans, codes of practice, initial white paper case studies, and a funding program to advance the industry. ANZBIG stands ready to work with and seeks government support for the next phase of the industry and commercialise applications across multiple sectors.

"Now is the time to develop Australia's clean future industries". The biochar sector is prime for development under the national Bioenergy Roadmap. ANZBI looks forward to helping ARENA and its team to realise its potential.

PART 2: Submission Response to ARENA's Specific Queries and Our Recommendations for the National Bioenergy Roadmap

1. Responses to Specific Feedback Queries

The following feedback is provided in response to the specific prompting questions listed by ARENA in its call for submissions to the National Bioenergy Roadmap.

1.1 General

ARENA Prompting Question	ANZBI Response
• **opportunities** where the bioenergy sector in Australia may have a **competitive advantage**, which may include: 1. the role of biofuels to help decarbonise the industrial and transport sectors and contribute to Australia's liquid fuel security 2. opportunities to decarbonise the gas network 3. bioenergy opportunities for heat, steam and power	Biochar applications have substantial potential market opportunities (refer Sections 1.2, and Part 1) and Australia is a recognized world leader in biochar research, technology and application (refer Appendices 1 and 6). At least five Australian scientists involved in biochar research are in the Web of Science "highly cited researchers" list (top 1% of ALL cited science not just biochar). Australian biochar technologies are now leading the world in practical mobile and centralized systems including recovery of energy and heat from Syngas. These can be applied in commercial and industrial applications including horticulture greenhouse temperature regulation (e.g. Echo 2 technology used at Holla Fresh Tantanoola SA). Biochar is recognised by the IPCC as one of the key Negative Emission Technologies (NETs), which will need to be deployed at scale to remove carbon from the atmosphere, in addition to reducing emissions, and displacing fossil fuels and other products with biomaterials to decarbonize economies. Biochar can support the bioenergy sector through: • **Producing valuable bio-products** (AUD >$500/t, more than 5x the typical price of coal) **can help make a bioenergy project more viable**. • Biochar is **one of six Negative Emissions Technologies** (NETs) identified by the IPCC (2018) as being required to be deployed **at scale** in order to meet the Paris Agreement goal of net zero emissions in the second half of the century. • Biochar provides for **carbon negative bioenergy with valuable co-benefits** (not just the expense of say geo-sequestration typically promoted for BECCS. • Potential to tap into significant sources and diversity of biomass • Leading technology, applications/use and research (some of the best researchers in the world are Australian – at least 5 scientists involved in biochar research are in the top 1% of **all** scientific citations globally, across all fields of science).

	• Linkages with and existing scale of agricultural sector • Large land area to support biomass, with opportunity to enhance productive areas and regenerate marginal. • Capability to innovate and develop new technologies • Assisting the transition of existing industries and power generation away from fossil carbon
• **current economic and regulatory impediments** to the development of the bioenergy sector in Australia	• Refer Sections 1.2 and 1.4 , Part 1 section 6 below specifically on this. • Additionally it is noted that the current international climate change agreements have indirectly created significant barriers to the sustainable exploitation of biomass. Most of Australia's improvement in its national carbon accounts have historically related to land use change which translates to restriction on clearing – particularly in Queensland but in most dryer areas of the continent. Progressing change is locked in outdated accounting around the definition of a "forest". The definition of a forest is 0.2 Ha 30% canopy and 1.5m height, and is caught by rainfall triggers. When this definition is applied to arid regions like mallee and brigalow what constitutes a forest is very different to what many in their mind think constitutes a forest. This is compounded by the use of satellite imagery to assess the extent of forest. The ability to manage landscapes for biomass production is hampered by a decade old carbon accounting issue. Notwithstanding this, policies for genuine sustainable recovery of those potential biomass resources already exist (including internationally) and leveraged upon to achieve it. • Income from biomass has the potential to tip the economics of clearing and forestry and other forms of agriculture. With the right controls, bioenergy could revolutionise agriculture and enable the sustainable use of vast landscapes (meaning triple bottom line environment, economic and social), including regeneration of current marginal lands.
• **understanding of the markets, technologies, resources, social and environmental factors** underpinning the current and potential bioenergy sector	Refer responses in Sections 1.2-1.7 below.
• **Insights into the economic opportunities for Australia**, including a focus on regional Australia	Refer Sections 1.2, Part 1 Sections 6 and 4, and case studies in Appendix 1.
• **any other relevant factors that should be considered** in the development of the roadmap	• Biochar can provide the significant advantage of achieving carbon dioxide removal (carbon sequestration) **AND** provision of renewable energy and heat / steam, and other valuable co-products including bio-oils / wood vinegar which are not currently given a

presence in documentation associated with the development of the Bioenergy Roadmap to date. However, Negative Emissions Technologies (NETs) including biochar and bio-sequestration are mentioned in the discussion paper (May 2020) for the overarching *Technology Investment Roadmap*. *"For these technologies to be viable at scale, Government will need to make strategic investments in R&D and demonstration activities now to see results beyond 2030, including in carbon capture and bio sequestration at scale."* The biochar sector presents an opportunity to add significant value to economic, environmental and employment potential of the Bioenergy Roadmap.

- ANZBI is a key stakeholder in the biochar and bio sequestration sector who can provide ARENA with an excellent 'vehicle' and leverage point upon which to accelerate the biochar and bio sequestration sector, and facilitate direct engagement with our members in the biochar sector. ANZBI provides a **complementary** service to the broader work of separate but related industry groups including ***Bioenergy Australia.*** who have not yet had specific focus on the solid carbon aspects of bioenergy that are well represented by ANZBI. ANZBI would welcome further direct engagement with the team developing the roadmap to assist wherever we can on these important aspects.
- ANZBI is soon to launch (July 2020) as a formal industry cluster as the ***Australian and New Zealand Biochar Industry Group (ANZBIG)***. Our taskforce is consulting with government agencies such as NERA on opportunities for support as a **formal emerging industry cluster,** including in relation to our role in facilitating **Carbon Capture, Utilisation and Storage (CCUS)**.
- A formal ***Business Plan*** and associated ***Funding Program,*** and a ***White Paper*** showcasing applications and economic benefits have been developed by the ANZBI Taskforce committee. ANZBI has existed on **virtually no government support to date and provides a significant opportunity for government-led acceleration**.
- Given the significant economic opportunity for post-Covid 19 recovery and regional employment that investment in biochar and the new carbon economy presents, combined with the emergence of commercialised technologies in Australia for safe and sustainable production of biochar and bioenergy for a rapidly emerging global biochar market, ANZBI believes that the timing for significant government support to the industry is now prime.

	• ANZBI would welcome further engagement with the government and the team developing the roadmap on such opportunities and the benefits our organization brings to the table to leverage support to the biochar industry as a valuable component of the bioenergy roadmap.

1.2 Markets and Technology

ARENA Prompting Question	ANZBI Response
• Bioenergy has the potential to serve many end-use sectors through renewable electricity, heat generation and clean transport fuels. However, bioenergy will compete with other sources of conventional and renewable energy. Impediments to its development may limit opportunities for deeper decarbonisation across the economy.	In addition to *"electricity, heat generation and biofuels"*, the **solid (biochar) co-product** from bioenergy technologies can serve many end use sectors and applications (as outlined elsewhere in our submission). The potential value of these to the Australian economy is significant and should be recognized alongside these other focal points of bioenergy for the new roadmap. **Biochar market potential is expected to be USD $3.1 Billion globally by 2025** (refer Doc 1 Section 4), with China, the US and Europe currently leading the way in global production of around half a million tonnes per annum. Australia is a recognized world leader in biochar research, technology and application (refer Doc 1 Section 7), which presents significant opportunity for growth. Biochar provides significant co-benefits for food production and security (i.e. can enhance, rather than compete) whilst also contributing to decarbonization / CO_2 removal (refer **Appendix 6**). Biochar can support the bioenergy sector through: • Pyrolysis can generate energy products from a range of biomass materials that are less suited to other bioenergy technologies, and biochar can be the economic driver for deployment of pyrolysis facilities. This diverts sources of currently wasted biomass (circular economy). • World leading applications (multiple sectors) • Transition of existing industries and power generation away from fossil carbon • Linkages with, enhancement of and existing scale of agricultural sector • Large land area to support biomass (including regeneration of marginal lands). • Leading biochar production technologies • Capability to innovate and develop new technologies • Capability to improve soil productivity and therefore biomass production to provide sustainable feedstocks for bioenergy (and agriculture), assisting both energy and food security.

• What are the key drivers and impediments to bioenergy development in Australia?	Drivers: • Should align with priorities of the overarching *Technology Investment Roadmap* • **Employment** (particularly regional focus) • **Energy security**, cost and reliability • **Circular economy** – diversion of residual wastes into valued added materials and commodities • **Emissions Reduction** – bioenergy co-product of pyrolysis displaces fossil fuel and biochar helps reduce other important GHG emissions such as potent N_2O and CH_4 in agriculture. • **Carbon Removal** (Negative Emissions Technology) – as noted elsewhere in our submission this is a key differentiating point warranting biochar's inclusion as an important component of the bioenergy roadmap. • **Economic benefits /economic opportunity** (multi-sector) In terms of the broader community and economy, the following drivers are also noted: • **Environmental co-benefits** (including action on carbon sequestration for climate change, improved ecosystem services etc.) • Embracement of **renewable energy** - global boom and "snowball" effect on uptake as costs fall and awareness rises. • **Financial impacts of Climate Change** – the significant economic costs associated with the increasing frequency of natural disasters (e.g. catastrophic bushfires) is increasing rapidly. These costs cannot continue to be insurable indefinitely, resulting in a willingness to pay for CO2 removal and emissions reduction technologies. • **Political will** (renewables/action on climate) In terms of **specific biochar applications**, **market drivers in Australia include**: ● **Biomass Resource:** profit, reduce disposal costs/risks (wildfires, smoke, GHG, landfill costs) ● **Soil Carbon Biochar:** increase soil productivity, reduce chemical fertiliser requirement, drought resilience, large carbon sink ● **Fertiliser Biochar:** profit, reduce nutrient losses to air/water, increase soil carbon & crop yield, offset traditional fossil based fertilisers ● **Animal Feed Biochar:** profit, livestock health/weight gain, food conversion efficiency, reduced odour/methane ● **Compost Biochar:** reduced odour, reduce composting time & C/N losses

- **Land & Water Remediation Biochar:** rehabilitation of degraded and contaminated land, reduce toxic or nutrient-laden run-off, return land to productive use
- **Asphalt Biochar: profit/reduced costs,** improved road durability, safety, cost, carbon footprint
- **Heating & Drying Potential:** reduced costs & supply risks, local circular economy, reduced carbon footprint
- **Electricity Potential:** reduced costs & supply risks, local circular economy, load balancing and grid stabilisation, reduced carbon footprint

Impediments (not in order):

- **Unequal playing field** with cheap fossil fuel energy (grid wholesale energy market prices are very low). Concessions and incentives could be considered to help the industry to reduce costs and grow to competing economies of scale.
- **Availability/Limitations in pilot demonstration funding** to enable new innovative technologies to bridge the "Valley of Death" to reach/prove bankable feasibility TRL. E.g. technology demonstration grants, unsecured or low interest project finance etc.
- **Lack of Market Development / Immaturity** – whilst biochar syngas market opportunities are high, they are still in their infancy and could be accelerated through substantial actions on market support (**demand-pull**).
- **'Disconnected' Stakeholders** – As with many industries successful bioenergy projects require significant integration between all stakeholders from biomass supply through to product/market off-takers, to investors/financiers etc. Broad stakeholder awareness would accelerate the industry.
- **Time and Cost to emerge new technology** from concept to bench to pilot to commercialization
- **Differing/Inconsistent regulatory frameworks across states** (affects interstate product markets)
- **Lack of approved carbon credit methods (ERF)** for government carbon credits (ACCU) for various applications (not just soils). A simple and effective biochar for soils method is ready for consideration (and more are proposed).
- **Access to feedstock –** lack of coordinated approach to identification and utilization of distributed biomass resources, need to continue funding work of projects like ABBA. Associated regulatory constraints. Associated infrastructure constraints. Also for distributed collection at farm scale, costs of collection and bailing can be significant OPEX impact on farmers so costs to supply can be substantial. Mechanisms which help farmers to provide these at lower cost will accelerate bioenergy project uptake.

	• **Network study and connection costs (grid energy projects)** – costs to entry can be large in some states and out of reach of smaller firms developing projects. • **Lack of Education and (subsequent) Social Licence** – lack of awareness of positive aspects of bioenergy, and prevalence of negative misconceptions (google searches quickly find extensive opposition to bioenergy internationally, typically around either sustainability or food security issues)
• What supply chain gaps act as impediments to bioenergy development in Australia??	• lack of coordination in identifying and accessing distributed biomass resources • Lack of broad industry and community understanding of the value of biochar and biomass resources. • Accessing "waste" biomass as a resource • Transport and handling costs can be disincentive to centralized / non-relocatable biochar and bioenergy systems, particularly for small demonstration pilots. • Immature bioenergy investment market • Inconsistent regulatory frameworks across states • Long term feedstock security and agreement • Lack of standards and codes of practice to provide buyer, community and regulatory confidence (ANZBI has worked to establish these). • CSIRO (2015) *Biofuels Ii Australia: Issues and Prospects* includes analysis of impediments.
• 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)?	Biochar systems which harness syngas for energy and heat recovery provide a competitive advantage of providing multiple valuable products – energy AND carbon removal sequestration, something not easily availed by most forms of bioenergy (even conventional BECCS using geo-sequestration). Provision of solid carbon for the new carbon economy (see 8.2.2. below) is also of potentially very significant value to the Australian economy (both in $$ and jobs), again unique to biochar for bioenergy. This includes potentially providing carbon for graphite for use in Li ion batteries for electric vehicles, which, along with hydrogen, is expected to play the key role in decarbonization of the transport sector. Competitive advantage should also be assessed similarly as done for the broader agribusiness sector, including factors such as access to markets, costs of supply, infrastructure, natural resource availability, innovation and macroeconomic factors, and context to global megatrends (NSW Agribusiness Report, Deloitte, 2019).
• What trends in the electricity, heat and transport markets will impact bioenergy development to 2030 and to 2050?	Electricity, heat and transport markets all play a key role in emissions and the IPCC target requires a 45% reduction by 2030 in order to meet net zero by 2050. With population growth estimated at 10 billion by 2050, there is increasing pressure to balance increased demand in all of these markets whilst also concurrently delivering emissions

	reduction. Given that biochar and bioenergy can play a key role in achieving both these combined needs, the market response is likely to be very positive. The governments of most countries, and now also many significant multinational companies (across multiple sectors), have/are committing to net zero 2050, but require CDR technologies in addition to emissions reduction to achieve this. It is reasonable to expect that demand for CDR through NETs such as biochar will increase significantly.
• 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?	A Global Opportunity: Australia leads the world in pyrolysis R&D and biochar application • **Global biochar market size is estimated to reach USD $3.1 billion by 2025 (Grandview Research 2019)**, and expected to expand at a CAGR of 13.2% by 2025. • Globally increasing demand for the product in organic farming has been a major factor influencing the growth. • In addition, increasing consumption in livestock feed and awareness pertaining to benefits of biochar as soil amendment are expected to drive the demand. • Very significant opportunities are also emerging in existing commercial applications in the construction sector (Carbon Capture and Utilisation), particularly in roads and concrete. • Biochar is an evolving industry and is anticipated to become a major influencing factor in increased crop yield and productivity of the agriculture sector. Biochar improves soil fertility and efficiency of use of nutrients in fertiliser. Moreover, applications in energy production and greenhouse gas remediation are expected to provide new revenue opportunities to the sector. • The United States, Europe, India, Japan, Mexico, and Brazil produce significant amounts of biochar through small and medium scale industries. Whereas, large scale manufacturers are concentrated in China. • In terms of volume, the agriculture sector is estimated to witness speedy growth over the forecast period with a projected CAGR of 12.5% by 2025"
• How is bioenergy development in Australia impacted by international and national factors?	• In a world of significantly increased inter-connectedness and social media presence, international factors are playing an increasing role in Australia in all aspects of life. Social licence can (and will) be affected by events from overseas, particularly high profile issues. For example – anti-fracking media from the USA (e.g. the documentary 'Gasland') impact on CSG policy in Australia, and the rapid mobilization of awareness through NGO networks like Lock the Gate.

	• Currently, a simple google search for "bioenergy documentaries" results in a number of negative media reports which can influence public response. • Globally there has been concern over sustainability aspects of some forms of bioenergy, including impacts on food security (food displacement by energy crops) and demand-pull impacts on deforestation. There are however effective policy responses and guidance available to support sustainable use of biomass, which need to be promoted substantially alongside the benefits of biochar and bioenergy. Refer Section 1.4 (including 1.4.1).

1.2.1 Opportunity in the New Carbon Economy (Bio Materials / CarbonTech)

Recent reports from the USA (Carbon 180, 2019) including industry roundtables with the large global corporations such as Shell, Exxon Mobile, BASF and 3M (among many others) investigated the potential of **transitioning from fossil-carbon** based products **to renewable carbon-based products** (solid, liquid and gas). These reports indicate significant potential in the US domestic market alone as indicated in the figure below. Biochar, bio-oils and syngas could help Australia in the ***new carbon economy*** to provide renewable and/or recovered carbon for more sustainable production of carbon-based products.

Many CCUS applications (Carbon Capture Utilisation and Storage) are available. One example includes ***green graphite*** for use in lithium ion batteries (Banek et al, 2018), which are already playing a key role in *energy storage* for the renewables boom and world energy transition. Bioenergy produced with biochar could also potentially assist other renewables in other ways, including night-time cogeneration allowing 24/7 dispatchable energy on demand, and mitigating issues suffered by solar and wind such as need for grid stabilisation (e.g. frequency modulation etc)).

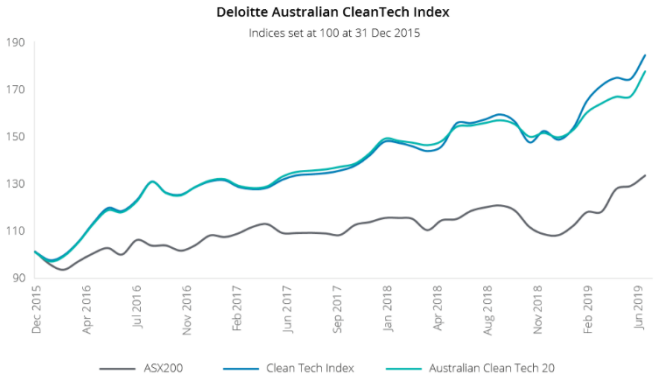
1.2.2 Cleantech – *Another case to increase investment in Biochar*

Biochar and associated bioenergy forms part of Clean Technology (see figures below). Biochar production (and associated bioenergy) can also play an important part in contributing to the continued success of the ***Australian Clean Technology*** sector including performance of the Clean Tech index (DACT).

Market wrap – 30 June 2019

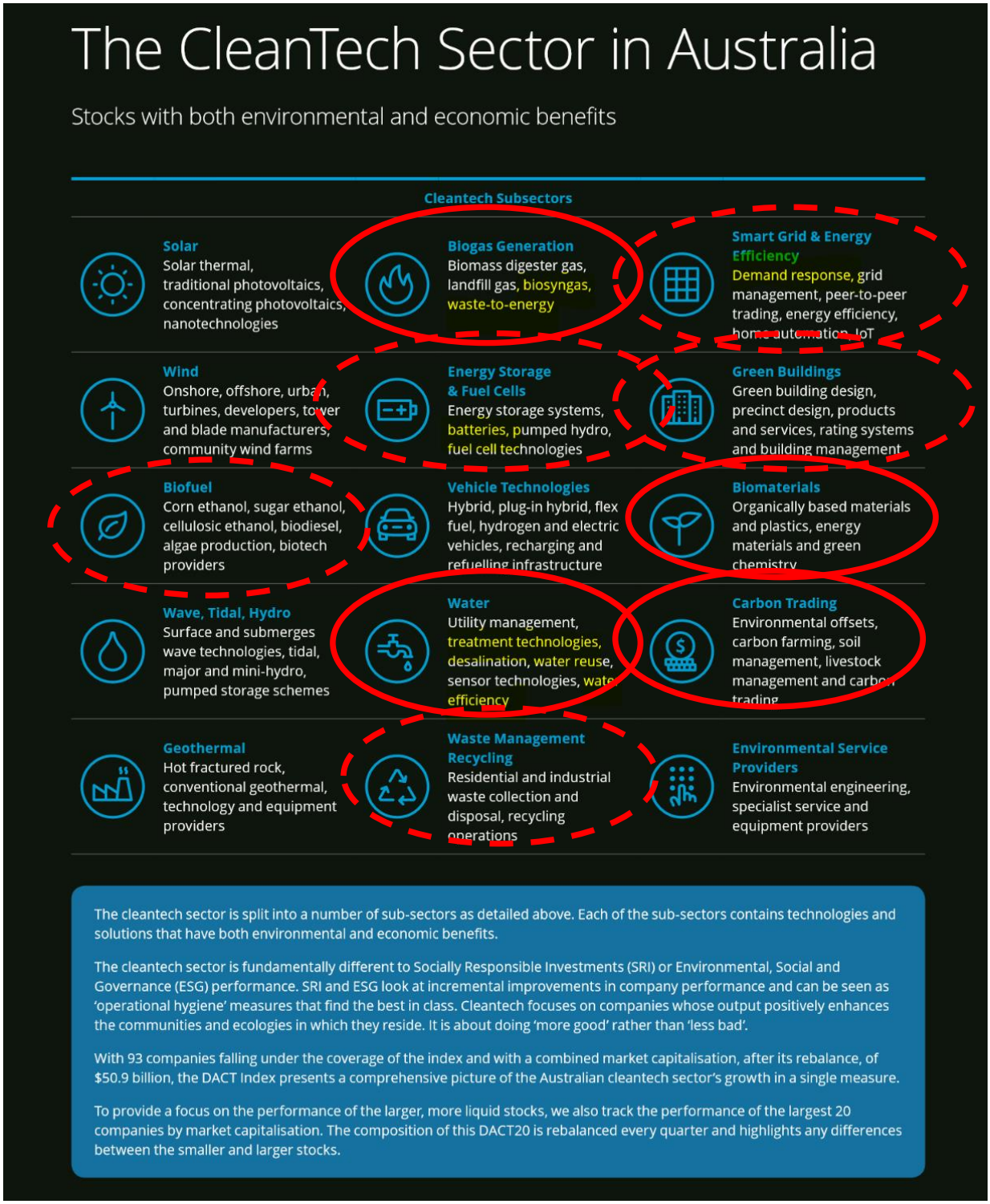
The performance of the DACT Index over the June 2019 quarter is detailed below.

% Change	Last Quarter	12 Months	3 Years	5 Years
ASX200	13.3%	13.0%	33.9%	29.8%
DACT Index	7.6%	18.8%	43.3%	102.7%
DACT20	8.4%	15.1%	42.6%	95.8%



Source: Deloitte Australia Cleantech (DACT) Index Report FY 2019

The potential role of biochar bioenergy to contribute to the Australian CleanTech sector:



Adapted from: Deloitte Australia Cleantech (DACT) Index Report FY 2019

1.2.3 Carbon Removal / Carbon Credit Markets

Government and private sector / voluntary carbon markets trading carbon credits have primarily focused on emissions reduction until recently. A number of private sector voluntary markets are also emerging **specifically dedicated to carbon dioxide removal** (CDR). These are already trading at significant value (eg biochar credits currently in excess of AUD $100 / tonne) and are likely to attract substantial attention as the world seeks Negative Emissions Technologies to balance their residual emissions as part of their strategies toward Net Zero 2050. Recent relevant developments include:

- CO_2 **removal** specifically valued and traded
- **Private sector (voluntary) markets already exist** trading specifically in carbon dioxide **removal (NETs)**, as well as emissions cuts (eg Puro Earth, Carbon Futures, Nori etc)
- Recent carbon credit auctions on Puro Earth (launched in 2019) have resulted in CO_2 removal certificate purchases of **Euro €16-23 /tonne of CO_2e**.
    - This currently corresponds to **over AUD $100/tonne of biochar** (typically >3t CO_2e per tonne of biochar, determined for each specific biochar traded based on its C content). For context, this is equivalent to about **~15-25% of the retail price for biochar** in Australia at typical current market rates. Accordingly, carbon removal credits can provide an important economic incentive to help facilitate biochar and bioenergy projects.
    - Biochar is one of 3 NETs currently trading on Puro (and the volume of biochar credits is growing).
- **Opportunity for Government markets (eg ERF ACCU's) to consider improvements to align** methods between ERF and international carbon credit markets, to expand demand for biochar credits from Australia? (apples with apples in GHG accounting and carbon flows) – Refer Section 1.2.4.
- Verification and auditing is a key feature. Digital document tracking technologies such as those used in stock exchanges (e.g. blockchain) are being employed.
- Potential linkages to the globally recognised **Built on *GHG Protocol*** platform (used by 8 of 10 Fortune 500 Companies to calculate their Scope 1 , 2 and 3 emissions….and soon, their offsets in combination with their own emissions cuts in order meet Net Zero 2050 commitments. Refer Section 1.2.5.
- Carbon credit suppliers who can provide demonstrated (science based), traceable quality carbon credits are more likely to retain higher value at auction into the longer term.

1.2.4 Biochar Carbon Credits: Opportunity for Government Markets (ERF/CSF and ACCUs)

Currently there is an approved method under the Emissions Reduction Fund (**ERF**), which from July will be known as the *Climate Solutions Fund*, or **CSF**), and its supporting *Carbon Farming Initiative (CFI)* for soil carbon ("Measurement of soil carbon sequestration in agricultural systems method", known as the "measured soil carbon" method) which does *recognise* use of biochar, however does not currently **credit** the stable carbon contained within the biochar itself (only for change in soil carbon in time following biochar addition; ie as an ameliorant to encourage growth).

Further, to date the significant **costs** associated with **measuring and verifying** change in soil carbon over time have been a substantial constraint to market adoption (especially for large broad acre areas), with only **one** (1) soil carbon project using biochar approved under the scheme by mid 2019. However it is understood that more project applications are under development, with advancing technologies for cost-effective measurement and other efficiencies combining to stimulate market interest in soil carbon as the largest terrestrial carbon sink for carbon dioxide removal (but also the most complex). Nonetheless, there is currently opportunity under the ERF for the inherent sequestered carbon within biochar to be easily accounted for and credited, addressing(past) queries regarding **permanence** (refer Part 1 Section 3 for more details on this). If the ERF measured soil carbon method was amended to specifically account for sequestered carbon value within biochar (similarly to the emerging dedicated CDR/NETs-focused private sector markets, see Section 1.2.3), then **many additional applications of biochar could potentially become viable for carbon sequestration credit too,** further increasing the value of biochar and bioenergy projects, helping drive investment in the sector.

To this end, it is noted that a **proposed method** under the CFI for biochar from pyrolysis of poultry litter for application to soil was jointly developed in 2015 by the University of New England (UNE) and the NSW Department of Primary Industries (NSW DPI). Importantly, the proposed method leveraged on significant research to propose a **practical, scalable and cost effective method for quantifying carbon sequestration within biochar** for its application to soil. This is also conservative in that it does not also include/allow for the additional *growth* in soil carbon attributable to biochar addition through *"negative priming effects"*, as research has since demonstrated (Weng et al., 2017).

Additionally, the method also accounted for the GHG emissions reduction/avoided through pyrolysis of poultry litter, instead of direct application to land and subsequent decomposition.

The method can be quite easily expanded for other feedstocks beyond poultry litter, and additional methods for other biochar applications can also be developed. ANZBI is promoting this approach in feedback to the Climate Change Authority (CCA) for a review of the ERF currently underway, and encourages the Bioenergy Roadmap to also do so.

1.2.5 GHG Protocol: Opportunity to drive carbon trading markets

With the emergence (and likely significant growth) of dedicated voluntary carbon markets in the private sector trading **specifically in carbon dioxide removal** (via NETs), underlying carbon removal accounting/calculation methods are being developed for each application. This presents potential opportunities (and need) to consider potential alignments of atmospheric carbon **removal** accounting methods with **emissions reduction** accounting methods.

- The ***Greenhouse Gas Protocol*** *(GHG Protocol)* established the international framework for Scope 1, 2 and 3 emissions accounting frameworks which are **used by 9 out of 10 Fortune 500 companies**.
- The GHG Protocol establishes **approved standard methods** and supporting **accounting tools**, recognised under a mark known as the *"Built on GHG Protocol"* (see figure below).
- Development of guidance on ***Carbon Removals and Land Use*** (which includes bioenergy) has recently commenced. An Australian representative (from NSW DPI) is a member of the Technical Working Group for this, who is also a member of ANZBI.
- **Opportunity exists for standard methods and new additional Tools to be developed and approved for many (if not all/most) applications of biochar that provide carbon sequestration.**

The faster these are developed, the faster carbon trading markets can start driving investment into biochar and NETs.

- Opportunity awaits for global leadership in pioneering these tools and methods which could potentially facilitate carbon credit trading for Negative Emissions Technologies.
- ANZBI is aware of proposals to do so within Australia which could be supported and accelerated by government.
- Public sector GHG accounting and carbon credits (eg ACCU's) should consider concurrently taking the opportunity to align methods as far as practicable.

- This presents a significant opportunity for the government to support, facilitate and hence accelerate the process. ANZBI would welcome further discussion with ARENA under the bioenergy roadmap toward this objective.

The "Built on GHG Protocol" mark recognizes calculation tools that are in conformance with GHG Protocol standards.

The GHG Protocol creates standards and tools that are applicable to any organization, company, and sector. In response to user needs, the GHG Protocol also develops calculation tools that build upon the more general standards. However, other groups and organizations are also developing their own tools to support GHG Protocol standards.

BUILT ON GHG PROTOCOL

The tools below were developed in close collaboration with the GHG Protocol, and have been reviewed to ensure that they are in conformance with the GHG Protocol standards. They have earned the "Built on GHG Protocol" mark, which recognizes accounting resources that have been developed in conformance with a GHG Protocol standard.

Learn more about the Built on GHG Protocol mark, and explore guidance that has been reviewed for Built on GHG Protocol conformance.

ANNOUNCEMENT | 10.15.2019 | MATT.HERBERT@WRI.ORG

New Greenhouse Gas Protocol Standards/Guidance on Carbon Removals and Land Use

The Greenhouse Gas Protocol is developing new standards/guidance on how companies and organizations should account for greenhouse gas emissions and carbon removals from land use, land use change, bioenergy, and related topics in their greenhouse gas inventories, building on the Corporate Standard and Scope 3 Standard.

Please click here for a description of the project and development process. If you are interested in participating, please fill out this form to participate in the Review Group, Pilot Testing Group, or to receive updates.

If you any have questions, please contact Matt Ramlow at Matt.Ramlow@wri.org or 1-202-729-7780.

1.2.6 Methods Separation and Alignment: Private and Public Sector Carbon Markets

Achieving the objective of Net Zero 2050 will require both reductions in **emissions**, as well as **removal** of existing CO2 in the atmosphere (via NETs such as biochar). These are two separate processes and should be accounted for separately to ensure the actions in each are maximised and continued carbon emissions are not simply offset and allowed to grow, in order to drive genuine climate mitigation.

Accordingly, as international trading platforms advance and carbon generation and sequestration flows are traded, there is potential for accounting to benefit from reviewing potential synergies. For example, it is not unreasonable to think that large international companies preparing their carbon **emissions** footprint accounting via GHG Protocol standard methods would be seeking to align carbon **removal** credits easily through the same/similar platform wherever practicable (apples and apples). It is understood there is already inconsistency between the Australian NGERS framework for GHG accounting (including generation of ACCUs) and International frameworks such as GHG Protocol. Given the ERF is currently under review, this may be a timely opportunity for this overall systematic aspect to be considered and addressed if/where practicable.

1.3 Resources (Feedstocks)

ARENA Prompting Question	ANZBI Response
• Australia has many sources of feedstocks through its agricultural, forestry and waste sectors. Understanding the feedstock potential can indicate the size of a possible bioenergy industry in Australia, which may be limited by conflicting uses and environmental considerations. • 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?	It is important to understand the difference in feedstock resources for biochar compared to production of fuels. In short, the biochar sector provides the **potential to further expand the usable feedstock base for bioenergy** as it can also process feedstocks typically not suitable for many *bio-fuels* (but noting some also feed AD for energy/heat etc.). In terms of their origin, feedstocks can be generally considered into a few main groups / categories: • **Photosynthetic Carbon** (bio forestry and bioenergy crops and residues, seaweed, macro and micro algae). These typically provide maximum sequestration benefit (atmospheric drawdown) • **Secondary Photosynthetic and Biogenic Carbon** (sludges / manures (biosolids), recovered woody wastes, food waste) • **Recovered/Recycled Anthropogenic Carbon** (non-biomass related carbon sources – these may represent avoided/reduced emissions (e.g. via prevention of biomass decay (GHG release), circular economy and/or fossil fuel displacement) more so rather than atmospheric carbon *removal* / sequestration. Various components of these are discussed further in the following sections below. • The ***Biomass Producer*** information platform provided by AgriFutures Australia (former Rural Industries Research & Development Corporation) provides analysis of biomass resources, project uses, constraints and opportunities (e.g. bagasse currently provides 60% of Australian bioenergy). State primary industries agencies also provide further analysis of agricultural waste residues. • The CSIRO completed a study in 2015 for the *Spatial Assessment of Potential of Biomass for BioEnergy in Australia* which quantified biomass estimates. • The *National Waste Report* provides statistical analysis of waste streams focused on waste to (and diverted from) landfill. This includes usage analysis including waste to energy. • **Forestry, agriculture, manures and biosolids (agricultural and municipal), invasive vegetation, and municipal organic waste (including food waste residues)** can each have application in bioenergy for syngas, power, heat/steam and biochar / bio oils / wood vinegar. Specific biochar applications necessitate different feedstocks and processing. A national

framework that helps identify, optimize and direct resources for various usages is required.

- **Urban green waste** and viably located forestry residues are often used for commercial composting. Unusable residuals are landfilled and should be diverted to bioenergy (as should all municipal organic waste that does not have viable higher order uses available- there are calls for bans organic waste to landfill, e.g. from Bioenergy Australia). Co-composting with biochar can reduce nitrogen losses (reducing GHG) and providing slow release nutrients (i.e. increases compost productiveness & value).
- **Surplus components of agricultural residues** which are still currently being burned and/or landfilled should be made available for biochar and bioenergy, allowing carbon to be returned to the land to build soil carbon and agricultural productivity and minimize net losses of carbon. Those who have managed soils well and can provide a net surplus of carbon stand to gain in the new carbon economy.
- **Food waste** - the Government estimates food waste costs the Australian economy $20 billion each year. Over 5 million tonnes ends up as landfill, enough to fill 9,000 Olympic sized swimming pools. One in five shopping bags end up in the bin = $3,800 worth of groceries per household each year. Whilst some of this is recoverable for higher order use (e.g. Foodbank estimates 2.5M tonnes), unusable components could and should be diverted for bioenergy.
- There is **potential for competition** for some feedstocks for use in various forms of bioenergy, however it is noted that many will not, as certain types of biomass lend themselves more to certain treatment types and products (e.g. wet organic wastes and sludges to AD, biofuels target specific types of biomass). As noted elsewhere in our submission (refer 1.4.1) , policies need to avoid competing land use and conflict, including beyond bioenergy (e.g. strategic agricultural lands containing our best soils should be identified and protected for their highest value (food production) as the world heads towards 10 Billion people by 2050. Protection of Australia's soils for food production whilst providing justified approaches for alternative use will be paramount. Enhancement of productivity on strategic soils, and **regeneration of marginal soils** provides an important role. Genuinely sustainable land use selection and supply of biomass is critical and should be undertaken in accordance with (or better than) available international policies on sustainable use of biomass (e.g. UN BEFSCI Project).

• Which energy crops have the greatest potential in Australia?	• Different crops can be utilized by different forms of bioenergy technology (e.g. wet biomass and sludge residues are well suited to AD technologies), and can also be influenced by product/application demand (e.g. energy crops in the USA). • NSW Department of Primary Industries has established trials of energy crops (including native species suitable for regeneration of marginal lands, increasing the productive capability of significant areas, whilst helping avoid land use conflict with food production).
• What are the potential environmental impacts and/or benefits (such as soil nutrients) of using a feedstock for bioenergy?	• Refer Part Section 7 and Appendices 1 and 6 for further information on the significant co-benefits of biochar (including on retaining nutrients and reducing leachate and runoff (including nitrates – a key risk to receiving inland rivers and coastal waters including coral reefs). • The environmental co-benefits of biochar are of global focus and have been extensively documented (typically are the focus of many of the thousands of research papers; not least for mitigating various facets of climate change, restoration of degraded soils, enhancement of agricultural soils, improved forestry management (including bushfire risk mitigation) and protection of coast reefs from agricultural nutrient and sediment runoff (a key threat to the Great Barrier Reef), among many others. • Refer Section 1.4.1 in regards to the importance of protecting strategic agricultural soils during development of bioenergy (and all development). Australian agricultural exports will play a key role as the world heads toward 10 Billion people by 2050. • A significant issue with bioenergy is ensuring the sources of biomass are genuinely sustainable and do not have significant negative consequences. For example, cutting down a native forest in order to grow a monoculture energy crop propped up on pesticides, herbicides, fungicides and fertiliser while displacing food production and habitat, is not a solution.
• Can these feedstocks be expanded sustainably, given land availability, water requirements and other environmental considerations?	• *"Biochar may represent the single most important initiative for humanity's environmental future. The biochar approach provides a uniquely powerful solution, for it allows us to address food security, the fuel crisis, and the climate problem, and all in an immensely practical manner."* **Prof Tim Flannery**, 2007 Australian of the Year • Refer Part 1 Section 7 and Appendices 1 and 6.

	• Biochar can sustainably enhance productivity of agricultural soils (maximizing productivity of our 'food bowl'), and (even more importantly), contribute to the regeneration of **marginal** lands. NSW DPI has commenced energy crop trials including **native** species targeted at marginal lands matched to water constraints. Rehabilitation of land disturbed by mining can provide a focus for energy crop development. • Beyond crops, biomass feedstocks such **biosolids** may provide a significant opportunity for bioenergy with sequestration whilst producing value added products, especially for municipal biosolids where land application may be limited due to the character of the biosolids. ARENA has commissioned a demonstration project in Logan Qld which is being closely watched around Australia.
• How will climate change impact the future potential of a feedstock?	• Climate change will impact rainfall, temperature an season temporal distributions (among other parameters) across different sub-regions, with corresponding changes to crop productivity in differing ways across Australia. Not all negatively, some areas will become more productive, whereas others will experience negative impacts including increase frequency and risk to natural disasters which may impact feedstocks (fire, rainfall, drought / flooding, storm damage / poleward migration of tropical cyclones, shorter growing seasons etc etc). Transitional planning (e.g. crop type transitions) will be required in affected areas, which will impact bioenergy projects over their project life. It also needs to be factored into associated infrastructure planning and investment. • Biochar's properties such as water holding capacity provide a substantial potential to assist **drought resilience** on farms (including agroforestry, cropping and bioenergy crop farms), and also in regional towns and communities, reducing municipal water use on sporting fields and golf courses (with significant financial savings (refer **Appendix 1**) and freeing up water for higher order uses and reducing negative media / conflict on water usage in agriculture (e.g. cotton farming), such as arose following the Menindee Lakes mass fish kill incident on the Darling River NSW in 2019. • Much work has been done by the Bureau of Meteorology, NSW Department of Primary Industries and the Aust Actuaries Institute in this space which should be considered in forward planning of bioenergy crops.

1.4 Public Policy

ARENA Prompting Question	ANZBI Response
International experience demonstrates a broad range of policy mechanisms have been useful to support bioenergy development. • What are the impacts of Australia's current policy mix on the development of bioenergy in Australia?	• Inadequate policy strength and direction (e.g. lack of integration, regulatory consistency, leadership / direction and certainty, and lack of national targets among others) results in poor market uptake, poor access to resources and capital investment, and delayed potential. Whilst Australia has significant advantages for biochar development, it currently lags substantially behind China, the US and Europe in annual production (~100x lower than China). This presents significant opportunity for rapid acceleration when these aspects are addressed. • Whilst support (including policy) for conventional renewables has experienced significant growth, projects can be primarily oriented to construction-benefits to local rural communities rather than longer term. Bioenergy technologies provide long term sustainable 'green' jobs, create integrated communities, and offer long term carbon drawdown potential, among many other co-benefits.
• Are there examples of successful State/Territory-level policy initiatives?	• Queensland Government has established itself as a national leader in promoting bioenergy publicly and strategically, including targets. Clear statements to industry and a range of policy incentives to bioenergy has helped drive investment beyond all other Australian states. • NSW has established policies which may be of assistance including Circular Economy, Energy From Waste (this has had complications due to legislation definitions), Climate Change, Decarbonisation innovation, Strategic Regional Land Use (see 5.3.1 below). • Victoria has some leading work in CleanTech (e.g. Victorian Clean Technology Cluster). More info available through ANZBI if needed (one of our taskforce is on the VCTC committee). • Victoria also has a dedicated agency for sustainability (Sustainability Victoria) with established guidance and codes of practice. • A "Green Triangle" for renewables (including biochar and bioenergy projects among others) has been established in towns across the South Australian and Victorian border which is well supported by local and state government. In 2019 ANZBI ran a Study Tour through the green triangle highlighting biochar and bioenergy projects such as Rainbow Bee Eater's ground breaking project at Tantanoola and others.

	• Western Australia has recently announced the Clean Energy Future Fund. The objective of the fund is to support the implementation of innovative clean energy projects in WA that offer high public value, significant cost-effective reduction in greenhouse gas emissions below projected (or baseline) emissions as a direct result of the clean energy project. • The WA Department of Agriculture and Food is supportive of local bioenergy projects using agricultural waste and food waste. Opportunities in WA are described in the 2014 Biomass scoping study: opportunities for agriculture in Western Australia [PDF 2.2 MB]. The Department of Finance provides information on the current and future use of bioenergy in Western Australia. Currently 7% of Western Australia's renewable energy is produced from landfill gas and biomass. • South Australia - in 2015 the Renewables SA developed the South Australian Bioenergy Roadmap, which is progressing through staged implementation. A Bioenergy Industry Development Program was developed to ensure that 'hotspot' regions are best equipped to develop the bioenergy potential for that area, and to help develop specific projects. • Refer also Section 1.4.1 below.
• What policy and regulatory instruments could further support the development of bioenergy in Australia?	• Incentivize genuine carbon removal mechanisms (NETs including biochar) **separately** to Emissions reductions, and on a life-cycle basis, to drive deployment of CO_2 removal and utilization (CCUS) that is climate-beneficial. There are range of financial options that have been investigated overseas (e.g. in the USA separate tax incentives for CDR technologies among others), as noted below (see Carbon 180). • Government departments have investigated biomass sustainability in the past to inform policy and which may be leveraged on for the roadmap. In particular those involved in primary industries including forestry and agriculture e.g. **Agrifutures** (formerly the Rural Industries Research and Development Corporation RIRDC) and state agencies such as NSW Department of Primary Industries. Whilst some studies are older they can still provide relevance. For example, the RIRDC produced the report '*Opportunities for Primary Industries in the Bioenergy Sector National Research, Development and Extension Strategy*' in 2014, and the '*Sustainable Production , of Bioenergy: A review of global bioenergy sustainability frameworks and assessment systems'* in 2009, among others including biogas recovery in intensive agriculture.. • Professor Ross Garnaut, one of the nations leading climate and energy policy advisors, has provided an

	analysis of carbon policy failures and options to address (including bioenergy) in his new publication *Superpower: Australia's Low Carbon Opportunity*. • Direct support for industry associations and industry clusters in bioenergy and biochar, including ANZBI / ANZBIG. • Direct support for pilot demonstrations and trials of bioenergy and biochar technologies, particularly at scale. Funding for such can be difficult to attain. For example, at least new bioenergy and biochar technologies (each on opposite sides of the country), were unsuccessful in seeking pilot demonstration funding under the *Regional and Remote Communities Reliability Fund* in 2020 primarily due to incomplete "fit" with grant criteria. Grants could be more customized to establish bioenergy technologies if that was a policy objective of government. .
• What lessons could be taken from overseas to inform Australia's bioenergy policies?	• **UN Council on Sustainable Biomass Production** - Draft Provisional Standard for Sustainable Production of Agricultural Biomass. Many international organizations (including in the European Commission) have investigated sustainability indicators and criteria for biomass utilization for bioenergy (examples here) • **State of California** (USA) has a substantial climate mitigation program involving advancement of biochar via state policies (among other aspects) (Contacts: Scott Morgan, Michael Maguire, Governor's Office for Planning & Research, www.opr.ca.gov . • **Sweden:** *Pathway to a Climate Positive Future: Strategy & Action Plan for Negative GHG Emissions after 2045* – Principles and Targets for Policy (SOU, 2020). • **Switzerland** – Federal Office of Environment Report Aug 2019: *The Role of Atmospheric Carbon Dioxide Removal in Swiss Climate Policy: Fundamentals and Recommended Actions.* The report indicates that ***biochar plus its effects*** *of soil carbon build up and other GHG emissions reductions, plus the clean energy of pyrolysis theoretically sum up to roughly* ***9MT CO2e per year ~ 18% of Swiss emissions",*** **and** ***"the technology is ready for use commercially in Switzerland (TRL 7-8)"*** • **UN FAO Bioenergy & Food Security Criteria and Indicators Project (BEFSCI)** – focus on sustainable bioenergy and addressing land use conflict (food security etc.). • **European Biochar Certificate (EBC)** – European certifier of biochar bioenergy, including policies for appropriate and sustainable sourcing of feedstock, including for feed additives. • **International Biochar Initiative (IBI)** – based in USA, extensive information on biochar bioenergy including case studies of what works (and what doesn't).

	• **Carbon 180** (US NGO think tank) (www.carbon180.org) has developed public policy guidance for carbon removal innovation, including tax concessions for CDR technologies, which may also be of interest to Australian policy makers. *"Carbon Removal Policy: Opportunities for Federal Action"* (2017) details bipartisan policy options, from legislative to regulatory action, that will drive carbon removal innovation. • **Stockholm Biochar Project (Sweden)** – Urban green waste to biochar (stormwater filtration etc) and renewable energy (YouTube presentation). Aims for 7kt of biochar in 2020 sequestering CO_2e equal to 3,500 cars, and produce 25,000 MWh of heat sufficient for 400 apartments. Multiple international award winner including Bloomberg Prize. Many global cities turning to this for inspiration. Contact: Mattias Gustafsson Project Manager. • ARC2020 – a peak body NGO in Europe for focused on better farming, food, rural and environmental policy and practice in Europe and further afield. From 2010 to 2015, ARC2020 were a European platform for 150+ NGOs, CSOs and farmer organisations advocating a reform of the European Common Agricultural Policy (CAP) between all EU countries.

1.4.1 Opportunities: Protection & Enhancement of Strategic Agricultural Soils (Australia's Food Bowl) and Help to Minimise Land Degradation

As the global population surges toward **10 Billion by 2050** (the same time the world seeks to reach net zero emissions), **the role of key food producers and net exporters** such as Australia will become of key significance. Forward land use planning for the **protection *and enhancement*** of the most productive agricultural soils for their highest order use becomes pivotal, in addition to improving and regenerating marginal lands. Australia is a leading food producer for the world and has both productive agricultural land, but is also home to the oldest geology on the planet with significant areas of eroded topsoil and, unfortunately, two centuries of clearing and less sustainable agricultural practices has resulted in significant topsoil loss and land degradation, resulting in increased areas of marginal land.

The IPCC has stated that ***lack of action to address land degradation will increase emissions and reduce carbon sinks, and is inconsistent with the emissions reductions required to limit global warming to 1.5°C or 2°C. Better management of soils can offset 5–20% of current global anthropogenic GHG emissions****. Measures to avoid, reduce and reverse land degradation are available but economic, political, institutional, legal and socio-cultural barriers, including lack of access to resources and knowledge, restrict their uptake.*

The IPCC has also warned that "*large-scale implementation of dedicated biomass production for bioenergy increases competition for land with potentially serious consequences for food security and land degradation.* ***Sustainable land management involves a comprehensive array of technologies and enabling conditions, which have proven to address land degradation at multiple landscape scales, from local farms to entire watersheds……..Proven measures that facilitate implementation of practices that***

avoid, reduce, or reverse land degradation include tenure reform, tax incentives, payments for ecosystem services, participatory integrated land-use planning, farmer networks and rural advisory services*. Delayed action increases the costs of addressing land degradation, and can lead to irreversible biophysical and human outcomes. Early actions can generate both site-specific and immediate benefits to communities affected by land degradation, and contribute to long-term global benefits through climate change mitigation.*

As noted above, globally one of the key criticisms directed at some parts of the bioenergy sector has been anticipated competition for biomass resources and land use conflict. For example displacement of food production by various energy crops has been politically sensitive in the USA and other places (and remains so). This has potential to impact the social licence of bioenergy and constrain or delay new projects.

However there are examples for both industry and government actions and policy which can assist the path toward achieving sustainable balance between regulation and all land development.

- **Industry Codes of Practice and Standards** can **adopt appropriate sustainability goals** including sourcing of biomass
    - International guidance exists (UN, European Commission etc) on sustainable use of biomass for bioenergy.
    - ANZBI has adopted sustainable sourcing of biomass in our draft Code of Practice released for comment in June 2020.
- **Government land use planning** can adopt approaches which appropriately protect resources, including:
    - **Sustainable Life Cycle Assessment** (LCA and SLCA) to assist land use planning and genuine integrated assessment across multiple environmental and social facets.
    - **Adopting land use planning policies** which identify, protect and promote enhancement of strategic agricultural lands and the most productive soils, and regeneration /enhancement of marginal lands.

Soil carbon (Soil Organic Carbon) plays a key role in soil productivity and represents the largest terrestrial sink for carbon. Improving agriculture to build soil carbon is one of the best options for reversing climate change while supporting sustainable farming. ***A 1% increase in SOC in the top 30 cm of soil translates to sequestration of approximately 165 tCO_2e per hectare*** assuming bulk density of 1.5t Soil/m^3 *(Soil Carbon Industry Group, 2020)*.

Low soil carbon contents (eg only 2%) in agriculture can be significantly increased toward ongoing sustainable productive levels (in excess of 5% and higher) through altered land management practices to improve soil carbon, including the addition of biochar (biochars should be tailored to match specific soil constraints – a key oversight in some biochar trials). Biochar has been demonstrated (refer **Appendix 1**) to help achieve the technical and commercial productivity and enhancement objectives. Along with policy support, direct support to the biochar industry sector (including the work of industry organisations such as ANZBI/ANZBIG) can help to both protect and enhance agricultural production as the nation moves toward 2050.

Example Case Study: New South Wales

- In 2011 potential land use conflicts in NSW between mining and agriculture regarding potential impact / degradation to land fertility and capability for continued food production came to a head in the community and media, resulting in the establishment of the *Strategic Regional Land Use Policy* for NSW (2012) and associated planning frameworks and site verification processes.
- **Under the policy, a framework for the states most productive agricultural soils** (aka Biophysical Strategic Agricultural Land, or **BSAL**) **would identify, assess and appropriately manage BSAL** for proposed mining developments.
- ***BSAL is land with high quality soil and water resources capable of sustaining high levels of productivity.*** It was defined further via an "interim site verification protocol" in 2013 with only twelve (12) draft technical criteria (importantly missing key criteria including organic content!).
- For BSAL soils that *were* identified, from an administrative effectiveness perspective, a decade of implementation of the policy framework showed identified BSAL can be protected (see figure below).

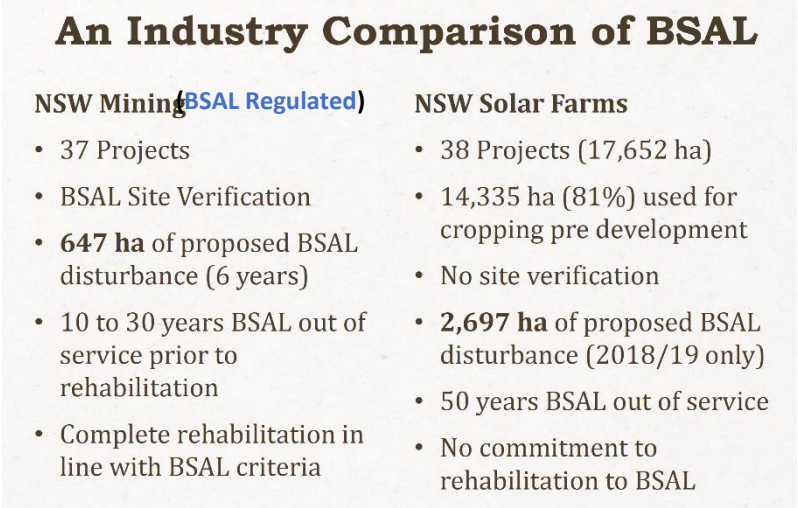
However*:*

- NSW's BSAL legislation was **only** applied to mining. Fast forward to 2019 and other industries (even green industries like solar renewables), have seen far greater impact on the state's most important agricultural soils, as highlighted below.
- **Definition** of BSAL was only a draft when introduced in 2013 but never revised as intended and committed to (over 20 recommendations from technical expert reviews were agreed but never finalised at administrative level). i.e. technical limitations in current definition but fixable *(Minesoils, pers comm 2020)*.
- **No subjectiveness** in the process even though was interim. Strict adherence to the (draft) technical criteria was problematic. *(Minesoils, pers comm 2020)*

The lessons from NSW which could assist the Bioenergy Roadmap are:

- NSW has an existing policy mechanism which could be leveraged on nationally to protect key agricultural soils whilst still facilitating significant development and avoiding land use conflict.
- **Effective structure/framework**, **but not perfect technically and requires updating** to be accurate in /reflective of identifying key strategic agricultural soils (see related comments below)
- This form of planning policy can (and should) be applied to **ALL** forms of significant development on BSAL soils, regardless of industry type (i.e. needs to be **implemented fairly**).
- Definition of BSAL land and development triggers requires a consultative, integrated process, especially to achieve consistency at a national level.
    - The current **definition** of BSAL in NSW (as drafted in 2013) **is inadequate.** Reviewed in 2014 by experts with nearly 20 recommendations for improvement to better characterise key agricultural soils (including **organic content**, among many technical aspects) but never reached ministerial finalisation. This should be revisited if to be adopted more broadly.

If pursued ANZBI would recommend it is undertaken in broad consultation with national and state soils and agricultural organisations, leading soil experts (CPSS etc) and the public, and that the above lessons are addressed (particularly technical including organic content.



Adapted from: NSW Mined Land Rehabilitation Conference, Minesoils Pty Ltd (June 2019)

1.5 Social Licence

ARENA Prompting Question	ANZBI Response
Bioenergy can provide many social benefits such as job creation, regional economic development and diversification of biomass-related markets. To realise these benefits, ongoing acceptance from local communities is critical to any bioenergy project in Australia. • What factors (such as shared economic benefits, safety and environmental impacts) will drive social acceptance and broad public support of bioenergy in Australia?	• **Trust** and **Confidence** between all stakeholders is pivotal and must be earned. This is the end result of many converging factors which differ between each stakeholder. Experienced and effective stakeholder engagement experts can provide steerage toward this. • There are many other sectors with examples on "Do's and don'ts" for effectively establishing trust. These should be leveraged and built upon to develop social licence for bioenergy. • **Factors influencing community and regulator trust are numerous.** Some examples include **sustainability** (refer Section 1.4); lack of standards and accreditation; past regulatory failures; incidents / negative press; confusion and misconception / misunderstanding (lack of awareness). Bioenergy is diverse and complex, some parts may attract more social licence issues than others. • **Biochar** can provide significant economic, social and environmental (climate and many other) benefits as noted elsewhere in our submission and has been a core focus for promotion by ANZBI which we believe can significantly support bioenergy acceptance if promoted more in Australia. • **ANZBI** has worked to address these key aspects for the biochar industry in developing draft Codes of practice and standards, a White Paper with case study examples across multiple applications, and providing a conduit for information sharing between industry, government and the community (e.g. conferences, webinars,

	extensive members library with decades of research papers etc), both nationally and also internationally (linkages to Europe, USA, China and many others).
• What are the conditions for maximising social licence for bioenergy development at national, regional and project levels?	• **Sustainable** sourcing of biomass (refer examples in Section 1.4) • **Net benefit** (social, economic, environmental triple bottom line) • **Genuine and Extensive Engagement** • **Awareness** of positive legacies of bioenergy, and also how potential problems are recognized, managed and avoided. • **Regulatory Confidence** (from government, and also from the community *in* government) • **Resource confidence** (economic availability and feasibility, including required infrastructure networks) • **Market confidence** (products benefit awareness) • **Investor Confidence** (this requires alignment of the above)
• What are the forms of bioenergy that are most likely to be supported?	• Australians are becoming more and more vocal on the need for action on climate change, including following the recent devastation of the biggest bushfire season on record. Climate change is also the number one concern for younger Australians. Forms of bioenergy that provide carbon **removal** / sequestration *and* emissions **reduction** will **be best positioned for social licence.** • International concerns for some forms of bioenergy to cause land use conflict and impact food security could present opposition in Australia. See related comments under Section 8.4 and 8.4.1 above. Ensuring (and promoting) genuinely sustainable forms for biomass for use is pivotal. Forms of bioenergy that both protect and enhance food security stand to gain support. • Forms of bioenergy that provide genuine circular economy and waste minimization, promoting the highest order use of resources under the waste hierarchy should be supported. • ANZBI recommends that the biochar sector stands well placed to help achieve all of the above. • **Important Note**: Thermal treatment technologies used for bioenergy (e.g. pyrolysis and gasification) can experience community and regulatory confusion / concern with use of the same technologies in other sectors/applications such as the concurrent emergence of "conventional" waste to energy used for Municipal Solid Waste (MSW), including plastics (which also use fully oxidized incinerators which have very different effects/emissions). These applications experience opposition in certain parts of Australia (**e.g. the ACT government just banned all forms of waste to energy in June 2020 which may likely also impact bioenergy).**

	Government awareness of **risks of blanket bans** impacting non-intended (and indeed beneficial) applications is a serious problem,. Forms of bioenergy that present lower toxic emissions risk (e.g. using pyrolysis and/or gasification with high emissions controls) may be more palatable to the community and regulators, particularly if successful case studies are showcased which do *not* also have significant impact on higher order use of resources (waste avoidance, reuse and recycling). Marseille in France is one recent international example. Australians will be following the progress of the new Kwinana project in Western Australia with great interest.

1.6 Key Stakeholders

ARENA Prompting Question	ANZBI Response
• Developing a bioenergy industry in Australia will involve many diverse stakeholders along the bioenergy value chain.	*"Successful bioenergy deployment necessitates a cross-sectoral, integrated approach where the efforts of all stakeholders –ranging from energy, agriculture and forestry, infrastructure, environment, technology and innovation, to economic and social affairs –are coordinated into concerted, sustainable action"* International Energy Agency (IEA) and Food and Agriculture Organisation (FAO), (2017) Further, it is very important that community and Non Government Organisations (NGO's) be genuinely engaged. Social licence is and will continue to be a key consideration for bioenergy going forward.
• Who are the key bioenergy stakeholders and what is their role in the development of the bioenergy sector in Australia?	Bioenergy and biochar applications will cut across many if not most major sectors of the economy. It is likely that as ARENA progress development of the roadmap and engage with identified stakeholders that additional stakeholders will come forward across all facets of bioenergy application. This should be allowed for in project planning. ***Biochar Stakeholders***: • ANZBI (www.anzbi.org) and its membership – ANZBI currently provides the coordinated forum for engagement with the biochar sector in Australia and its members. • As noted elsewhere in our submission, ANZBI will soon be launching (July 2020) as the ANZ Biochar Industry Group (ANZBIG) as a formal industry cluster. ANZBIG will approach government agencies (such as NERA) focused on promoting industry clusters for CCUS, decarbonization and renewable energy. Accordingly, we recommend the national bioenergy roadmap also

engage with government agencies tasked with those common goals (including NERA among others).
- See also government regulators etc below.

Other Bioenergy Stakeholders:

- Bioenergy Australia
- Govt energy / renewable energy agencies at Federal and State level (e.g. Australian Energy Market Operator (AEMO), National Energy Resources Australia (NERA), Clean Energy Regulator, Future Fuels CRC, various biogas organisations including infrastructure (numerous)).
- Consideration should also be made for engagement with **conventional renewables** (incl Hydrogen) in regards to overlapping interests including **co-generation with bioenergy** (e.g. solar-biomass).

Agricultural stakeholders:

Extensive stakeholder identification is required in this broad sector as there are numerous organisations involved.

- Government Agricultural Agencies (Federal and State). e.g. Rural Industries Research & Development Corporation (Biomass Producer platform), CSIRO, CRC's, state Departments of Primary Industries, Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), etc).
- Farmers and farming organisations at federal and state levels (e.g. AFF)
- Agricultural research groups (e.g. Agrifutures)
- Carbon Farmers Australia
- Soil Carbon Industry Group
- Relevant Cooperative Research Centres (eg Soil CRC)
- Regenerative Agriculture Australia
- Australian Landcare
- Organic Federation of Australia
- National Association for Sustainable Agriculture Australia (NASAA)
- Organic Industries (association)
- Intensive agriculture organisations (for agricultural biosolids, eg poultry, cattle feedlots, dairy etc). EG Meat and Livestock Australia etc.
- The Australian Govt *White Paper on Agricultural Competitiveness* can also help identify key stakeholders including interested parties who made submissions.
- Note: Some of Australia's largest mining companies have significant agricultural interests (eg Glencore etc). Bioenergy has substantial potential on both buffer land management and in mine rehabilitation.

Municipal Organic Waste and Waste Water Treatment

	• Waste Management & Resource Recovery Association of Australia (WMRR). • Biosolids organisations (eg Australian and New Zealand Biosolids Partnership, Australian Water Association, Australian Wastewater Treatment Association) • Relevant government departments and agencies for biosolids management at Federal and State level • Food waste organisations (including NGOs such as Ozharvest etc). • Companies involved in large organic waste collection (eg Mixed Waste Organics). Significant expenditure has been made in this sector in Australia. *Sustainable Forestry* • Forest Stewardship Council • Agroforestry in Australia www.agroforestry.net.au • Australian Agroforestry Foundation www.agrofrestry.org.au • Australian Forest Products Association (AFPA) • Australian Forest Certification Scheme www.forestrystandard.org.au • Responsible Wood www.responsiblewood.org.au/ • One Tree Planted www.onetreeplanted.org.au • Reforest Now www.reforestnow.org.au • Timber Workers for Forests www.twff.org.au *Environmental Regulators (State and Federal):* • State EPAs (Environmental Protection Authorities) • Planning and development agencies • Waste and circular economy agencies *Decarbonisation Thinktanks & NGO's*: • Beyond Zero Emissions (BZE) – www.bze.org.au • Climate Council – www.climatecouncil.org.au • Climateworks Australia - www.climateworksaustralia.org • 2040 https://whatsyour2040.com • Cool Australia www.coolaustralia.org (education) • Carbon Market Institute: Australian Carbon Industry http://marketplace.carbonmarketinstitute.org • Global Product Stewardship Council www.globalpsc.net (HQ in Sydney, Australia) • Environmental Groups and NGO's with interests in renewable energy and sustainability.
• What special expertise and insights do various stakeholders bring?	Globally, some of the leading industry frameworks in the world (eg silicon valley) resulted from strongly integrated relationships between government, industry, investment and research to drive innovation and commercialisation. When combined with genuine broader engagement to

	develop social licence this may likely present a winning formula for successful collaborative projects. Industry associations such as ANZBI and Bioenergy Australia provide important catalysts connecting all stakeholders toward common goals.

1.7 Other Specific/Relevant Matters For Consideration

Section 9 of our submission proposes a range of recommendations for consideration by the government, ARENA and its consultants in developing the National Bioenergy Roadmap.

In addition, ANZBI would welcome (and requests) further engagement during development of the roadmap. We also recommend engagement with other organisations involved in biochar and CCUS. ANZBI would be pleased to assist in identifying these organisations (both private and government) if needed.

2. Recommendations

The Australia New Zealand Biochar Initiative (ANZBI) appreciates the opportunity to provide feedback on the development of the National Bioenergy Roadmap, and makes the following **twenty (20) recommendations for consideration:**

1. **Facilitate strategic use of bioenergy and biochar to support rapid decarbonisation as a key priority to help meet net zero carbon emissions by 2050.**

2. **Establish overarching guiding principles to assist bioenergy and biochar industry sustainable development** (note ANZBI has provided a head start with a draft Code of Practice ready to accelerate the official launch of the ***ANZ Biochar Industry Group (ANZBIG)*** in July 2020, as noted below).

3. **Increase Government engagement and support to accelerate the CCUS biochar industry sector via ANZBIG**. Currently, ANZBI/ANZBIG self-funds all administration and operations (much with unpaid volunteers), including development of a Business Plan, (draft) industry Code of Practice and standard, and Funding Program to take the industry to the next level (i.e. the groundwork is ready for government to fund and accelerate). ANZBIG can play an important role in Australian CCUS industry cluster development.

4. **Conduct larger scale** (broadacre) **Industry Demonstration Projects across multiple biochar applications/uses**, including replicating successful case studies in other areas/states. For example, in agriculture, replicate highly successful west coast beef cattle and avocado demonstrations (e.g. Doug Pow) in other states.

   4.1 More large scale field demonstrations are required to evaluate the applications of biochar and biobased chemical fertilisers given their demonstrated capacity to outperform commercially available slow release fertilisers, and for water efficiency / drought resilience.

   Field trial results from China[19,41,42,45] and more recently Australia[43] demonstrate biochar fertiliser's capacity to outperform commercially available slow release fertilisers (refer **Appendix 1** for further details). These products offer the dual benefit of substituting existing fertiliser costs while increasing crop yields. While more research is required to continue confirmation of the benefits of biochar fertilisers, the high relative performance of these alternative biochar products and their subsequent potential for user value creation suggest they have the capacity to overcome the economic constraints that can be faced by biochar use in cereal agriculture, and to deliver considerable benefits to higher value crops.

   A number of potentially significant benefits in water efficiency and drought resilience / increased water security have also been identified across a number of applications and sectors. These include (but are not limited to) agriculture / horticulture, municipal sporting fields, rehabilitation, and golf courses among others (refer **Appendix 1**). The return on investment for applications such as golf courses include case studies with ROI of << 1 year, noting significant savings due to reductions in water and fertiliser usage of up to 50%.

   4.2 Large scale demonstration projects are required where biochar is a component of a larger effort to utilise waste resources (e.g. wood residues from forestry, clean commercial and industrial timber etc) to reduce nutrient runoff and increase soil health. The projects need

to be well-resourced so that they do not require any significant input from farmers over and above their normal day to day activities.

4.3 Livestock Health, Productivity & Methane Reduction: In addition to economic and other environmental benefits, biochar has been demonstrated to reduce methane production from cattle (refer **Appendix 5**). The extensive global cattle population results in methane burping as a significant global contributor to climate change, being 23 times more potent as a GHG than CO_2). The Australian government has identified advanced methane reduction in agriculture as a target for funding. ANZBI recommends ARENA further investigate this important application accordingly and is happy to facilitate further discussion.

4.4 Document and promote case studies (existing and new) in biochar, wood vinegar and bioenergy applications, in multimedia formats easily accessible to community and scientists.

5. **Facilitate state and federal discussions toward nationally consistent Policy and Regulatory frameworks for Bioenergy** (eg even contaminant guidelines differ from state to state, let alone state-specific regulatory constraints and inconsistencies. If the intention is larger scale industry, national product markets wont "know state boundaries"). Outcomes-based and risk-based regulation (e.g. following ISO13065, 2015) with clear goals and principles to guide development.

6. **Establish dedicated bioenergy officer(s) in each State (and a federal one)** within appropriate agencies (and/or establish agencies if required) to is to facilitate all forms of bioenergy and biochar, to act as point of contact with industry, to foster industry development and collaboration with regulators (including EPA's), work through barriers, and provide guidance on the relevant regulation in each jurisdiction. Providing visible support within government nationwide for bioenergy also assists building community trust and social licence.

7. **Establish a National Sustainability Certification system for bioenergy and biochar** aligned with international systems.

8. **Proposed Australian Bio Industries Fund** -Bioenergy Australia has recently called for an Australian Bio Industries Fund to be established and for Additional Stimulus Mechanisms, complementary with a Clean Futures Target (see below) and the National Bioenergy Roadmap. ANZBI would recommend that such endeavours also specifically include carbon removal and biochar, and also support of the sector itself through industry support to ANZBI. ANZBI would welcome further discussions with the government to this end.

9. **Set Clean Futures Targets** - ANZBI is generally supportive of the recent calls by Bioenergy Australia for a Clean Futures Target, however with additional amendments to support inclusion of the role of biochar and carbon **removal/sequestration** through inclusion/support of CCUS and PyCCS. As stated earlier in our submission, solid carbon products including biochar from sustainably sourced organic materials provides a significant environmental and economic opportunity for Australia to tackle climate change whilst providing regional employment and generating high value products (the ***new carbon economy***).

10.1 Net Zero Organic Waste to Landfill Target *and the* ***ERF/CSF Jobs Target*** proposed by Bioenergy Australia should also include context in regards to carbon sequestration and biochar applications/industries.

10.2 Additionally, the **inclusion of carbon removal / sequestration targets** (to complement emissions reduction targets toward Net Zero 2050) is recommended. Global studies on policy reforms for establishment of targets (such as those published here by the Carbon Brief), recommend an important action to **ensure formal separation of carbon dioxide removal targets** ("negative emissions") **from emissions reduction targets**, **rather than combining them in a single "net-zero" goal**. i.e. separate targets and accounting for carbon removal (via NETS) as compared to emissions cuts (Scope 1,2,3 reductions). Explicitly setting and managing targets and accounting for negative emissions separately could help to address identified policy problems, and **maximise additionality** of carbon removal, ensuring that negative emissions are appropriately valued. Separation would have important implications for climate target definition; offsets and carbon trading; incentives; and modelling and evaluation processes.

10. **Support revisions to the Government ERF/CSF and associated carbon accounting (NGERS etc) to include biochar methods for carbon removal to help establish new carbon credit mechanisms to provide additional drawdown (ACCUs) and "demand-pull"**. ANZBI has developed an initial method and proposes further. ANZBI is making a concurrent submission on the current ERF review underway by the Climate Change Authority, which can also be cross-referenced and considered for context under the Bioenergy Roadmap.

11. **Support development of new standards/methods for carbon removal mechanisms (drawdown) for biochar applications recognized internationally under the GHG Protocol (GHGP) via the underlying *"Built on GHG Protocol"* platform, allowing international trading of carbon credits from biochar applications on multiple trading platforms.**

    - The GHGP is internationally recognised by 9 out of 10 Fortune 500 Companies as a globally accepted methodology for their Scope 1, 2 and 3 emissions calculations.
    - The *Built on GHG Protocol* mark and logo recognizes products that have been developed in conformance with a GHG Protocol standard. Those that acquire the mark will benefit from the GHG Protocol's reputation as the gold standard for GHG accounting.
    - Accordingly, **developing and aligning separate but corresponding GHGP standards for carbon removal** (negative emissions) **for various biochar applications and products** would provide a launching pad for private sector carbon trading across multiple (existing) trading platforms worldwide. i.e. accelerate demand-pull from the private sector via world's largest companies committed to Net Zero 2050 who will require more than just emissions cuts to achieve this.

12. **Support Awareness, R&D, and Commercialisation of Biomaterials and Carbontech Products and Applications**
    - ***Policy Support*** – Engage with CCUS industry groups including ANZBI and CO2 Value Australia (among others). Refer to international examples for potential government policy reform which accelerate the new carbon economy and carbon dioxide removal (eg through Carbon 180 in the USA), considered in the Australian context.

13. **Integration of land based and bioenergy programs** – for example: provide incentives for beneficial use of existing biomass residues, plus incentives for planting programs for dedicated bioenergy crops.

14. **Devise policy incentives** that are technology neutral and driven by climate change outcomes, and calculated for individual projects/systems, recognising that climate effects are context-dependent. This will help ensure that biomass is used in the most effective ways to deliver climate change mitigation. Leverage and build upon components of successful existing state policies and other international examples.

15. **Resource significant marketing campaigns promoting the positive aspects of bioenergy (including biochar)** to increase community awareness and social licence. Many people still don't understand what actually *is* biomass, bioenergy and biochar.

16. **Establish *Bioenergy Patrons* to endorse bioenergy –** these should be well respected and multi-disciplinary, (including non-science, non-government, from all facets of our community).

17. **Fund consolidation/summary of available research findings on applications of biochar.**
    a) **consolidated scientific summary of studies to date** *(This avoids scientists having to wade through all the work to date. E.g. there have been "XX" papers on biochar use as an activated carbon for water treatments. Findings concluded that "XXX").*
    b) **consolidated general/community summary -** separate version of the scientific summary, presented in formats easily understood by the broader community (including buyers and political representatives too) who aren't aware of biochar and bioenergy. This should include multi-media communication formats (not just documents).

18. Establish a ***Biochar and Bioenergy Information Clearing House*** resourced appropriately to provide the information conduit between the biochar and bioenergy industry to the broader market, buyers, the community and government. This would provide an easily accessible online platform (and potentially physical phone support) for dissemination of national an also international information (now considerable) across multiple forms of electronic media (eg online informative videos, consolidated and individual research papers (see related recommendation above), economic case studies, marketing, and education).

19. **Biomass Resources Identification** - Continue/reinstate appropriate funding of biomass resource mapping projects such as the ABBA project, federally and at state level. The program should also assess opportunities for both centralised and decentralised biomass resource recovery.

20. **Differentiate between biogases (including syngas) and fossil-fuel gas (eg LNG, CSG)** – communicate the **positive** differences to the general public clearly to assist social licence as bioenergy develops concurrently with a proposed expansion to the fossil-fuel gas sector at same time which may likely be confusing. The latter is receiving some negative press for the government's proposed "gas-led recovery" to Covid 19. Similarly, suggest a similar approach to differentiate biomaterials for the new carbon economy from conventional fossil-C materials (e.g. many people don't even realise conventional plastics are made from oil).

21. **Facilitate interaction between stakeholders** in a neutral environment to develop shared understanding of the potential benefits and challenges in the bioenergy and biochar industry. Shared understanding through genuine engagement could enhance support for sustainable bioenergy and biochar projects, and could lead to improved projects with multiple benefits. This may also support advancements in community acceptance and social licence for bioenergy and biochar more broadly.

22. **Increase attention from users, producers, government and private sector agronomists, agricultural scientists and academics to alternative uses of biochar beyond focusing on soil amendments**. E.g. animal feed supplements, water holding capacity (reduced irrigation / drought resilience), partial replacement of chemical fertilisers, environmental remediation, mine rehabilitation etc.

Thank you for the opportunity to provide this submission.

Australia New Zealand Biochar Initiative (ANZBI)

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Appendix 1: White Paper: Users Report on The Value of Biochar and Wood Vinegar (ANZBI, 2019)

Appendix 2: Biochar in China – Perspective on Scale and Application

Appendix 3: Biochar in USA & Global Perspective

Source: International Biochar Initiative (IBI), T.Miles, 2020. .

Appendix 4: Pyrogenic Carbon Capture and Storage (PyCCS)

Source: Schmidt et al 2018. .

Appendix 5: Biochar Feed Supplement Technical Report (March 2020)

(M.Rebbeck and S.Joseph 2020). .

Appendix 6: Example Key Research Papers

Appendix 7: Carbontech Market Reports

Source: Carbon 180, 2019