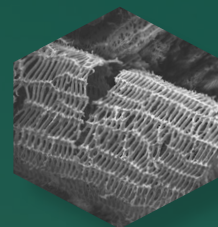


Version 1.0
June 2023



Australian Biochar Industry 2030 ROADMAP

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Notification

This Roadmap is a living document and has been published by the Australia and New Zealand Biochar Industry Group (ANZBIG). The document represents the views of the authors at the date of publication reflecting currently available information and insights, using the best endeavors in the quality of information presented. Any representation, statement, opinion or advice expressed or implied in this publication is made in good faith and on the basis that ANZBIG is not liable for any damage or loss whatsoever which may occur as a result of action taken or not taken, as the case may be in respect of any representation, statement, opinion or advice referred to herein, including the completeness or accuracy of information presented. Professional advice should be obtained before relying on or applying the information contained in this document to particular circumstances.



Foreword

The Australian Biochar Industry Roadmap is a call to action. It demonstrates and explains the huge potential for growth of biochar production and use in Australia. Making this potential real will deliver major economic, environmental and social benefits.

Better utilisation of currently wasted and residual biomass resources for biochar production can provide valuable inputs into agriculture and industry. In agriculture, biochar can improve soil fertility and increase moisture retention. Fed to cattle or sheep, biochar can improve digestion so that more feed is converted into increased meat, milk and other animal products, and less methane is released. In industry, biochar can provide a renewable source of inputs that would otherwise be drawn from coal, oil or gas and contribute to carbon emissions. It can contribute this value while capturing and storing for long periods the carbon that has been absorbed from the atmosphere by plants. The long-term storage of carbon as biochar is recognised as a secure source of negative emissions.

The Australian Biochar Industry 2030 Roadmap comes at an important time, when we need to lower emissions quickly, and to develop new sources of economic growth.

The production of the Roadmap is a tribute to ANZBIG, the peak body of the growing biochar industry. The Roadmap embodies the results of extensive participant consultation. This not-for-profit group has attracted members and supporters from biochar producers, biochar users, capital providers, research scientists, engineers, and citizens with an interest in climate change action. ANZBIG's Roadmap will inform the community and illuminate the case for new policies from all Australian governments.

ANZBIG's Roadmap is especially timely. The 2020s are the critical decade, in which people with influence now will take decisive steps towards stopping the trend to higher global temperatures, or leave future generations with an impossible task.

Australia has the resources to strengthen its economy through developing net zero targets, while removing its own emissions and contributing substantially to net zero emissions in the rest of the world. Biochar can make significant additions to these important outcomes in the years to 2030, and much more after that.

The ANZBIG Roadmap demonstrates the contribution biochar can make to Australian economic and environmental goals. Community understanding of the Roadmap will drive removal of barriers to increased development of this new industry. High levels of investment will follow introduction of policies that recognise the value of innovation in a burgeoning industry that has potential for large expansion, and the value of removing carbon dioxide from the atmosphere.

I look forward to working with you in making progress in the directions defined by the Roadmap. And I look forward to the biochar industry making a major contribution to the emergence of Australia as a Superpower of the net zero world economy.

Ross Garnaut AC

Patron, ANZBIG, May 25, 2023

**ANZBIG's
Roadmap will
inform the
community and
illuminate the case
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Acknowledgments

This Roadmap represents the ideas and efforts of many people and organisations working in the biochar sector. It is a collective and collaborative process that has driven the concept and development of the Australian Biochar 2030 Industry Roadmap.

The extensive consultation and strategy work embodied within this roadmap was led by Russ Martin of MS2 and supported by Shaun Scallan of Sustainability Plus Projects. We recognise their significant work in preparing the draft Roadmap and strategy documents now embodied within this Roadmap.

Special mention is required for the significant contributions of Nigel Murphy, Craig Bagnall, Melissa Rebbeck, and Professors Stephen Joseph and Annette Cowie.

The ANZBIG Executive and Advisory Boards should also be acknowledged together with the staff of ANZBIG, capably led by CEO Don Coyne and Cluster Manager Sam Zagami.

ANZBIG also acknowledges the biochar pioneers that have created our industry. Without their inspiration, persistence, and belief we would not be the exciting industry of today.

Design and layout: Rosie Moulton

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Supporters and Sponsors

The development of the Australian Biochar Industry 2030 Roadmap has been supported by many organisations. We acknowledge and thank them for their support.

Diamond



EARTH SYSTEMS
Environment | Water | Sustainability



Silver



Bronze



Carbon Drawdown Projects



Sustainability Plus Projects
Restoring our Earth through sustainable practice



Executive Summary

Biochar provides Australia with an important economic, social and environmental opportunity if scaled successfully. Over 50 million tonnes a year of commercially accessible sustainable biomass residues are currently being burned, landfilled, or under-utilised. This Roadmap, produced by the peak body for biochar in Australia, ANZBIG, outlines the approach required to successfully seize this opportunity by 2030.

The Australian biochar industry has world-leading biochar technologies, research and significant residual biomass resources. The industry is ready for scale-up, requiring a concerted effort from industry, research, government and capital investment to deliver on this opportunity.

Biochar has been identified as a key source of non-fossil carbon with the potential for many important applications in our society including as an enhancement to land and agriculture, and as an important additive for industrial applications.

Biochar production is one of the carbon dioxide (CO₂) removal methods, also known as negative-emissions technologies (NETs), recognised by the United Nations' Intergovernmental Panel on Climate Change (IPCC) as an effective method for climate change mitigation.

Successful implementation of this Biochar Roadmap by 2030 has the potential to reduce Australia's net carbon emissions by 10-15%, provide up to 20,000 permanent jobs (especially in regional and rural areas), improve soil health and agricultural productivity and return degraded lands to a higher value.

The production of biochar provides a sustainable and climate-friendly opportunity to convert millions of tonnes of wasted organic resources into valuable carbon products and renewable energy for a circular and regenerative new carbon economy.

The outlined Roadmap Actions will assist in scaling the current biochar industry to a multibillion dollar per year industry by 2030 (estimated to be at least \$1-\$5 Billion per annum) that sustainably drives economic efficiency and climate change mitigation in Australia.

The roll out of the Roadmap will require strong collaboration across Australia from industry, government, research and capital. The resourcing of the Roadmap should be a strong priority for the organisations that will benefit from a thriving biochar industry.

The implementation of the Roadmap Actions over the 2023 to 2030 period will provide a firm basis for a successful biochar industry in Australia and contribute substantially and economically to Australia's climate change mitigation obligations.

Nigel Murphy

Chairman, ANZBIG, June, 2023

The Roadmap Actions will assist in scaling the current biochar industry to a multibillion, dollar industry by 2030, sustainably driving economic efficiency and climate change mitigation in Australia.



An Introduction to the Roadmap

Why produce a Roadmap?

A biochar industry Roadmap is necessary to catalyse the sector. Whilst there has been significant development and growth in the sector over the last couple of years there are still many hurdles and obstacles to overcome to enable the industry in Australia.

ANZBIG as the peak body for the biochar industry has developed the Roadmap and is seeking an inclusive and consensus driven approach to growing the industry. Following industry consultation which noted key differences and needs, a separate roadmap for the biochar industry in New Zealand will also be developed.

Who is ANZBIG?

ANZBIG is a not-for-profit association that assists companies, governments and institutions in the effective production and use of biochar. The industry group facilitates and streamlines biochar education, research, collaboration and commercialisation activities to provide better outcomes for the biochar sector in Australia and New Zealand. ANZBIG has developed the Code of Practice for the Safe and Sustainable Production and Use of Biochar in Australia and New Zealand.

What is biochar?

Biochar is a charcoal-like product made by heating any form of organic matter (biomass) in a controlled process with limited oxygen, called pyrolysis. This product is called biochar when it is used as a soil amendment, or for other uses that store the carbon in a durable form.

The carbon content and properties of biochar vary depending on feedstock, but biochar can be more than 90% carbon. Biochar is characterised by distinct physical, biological and chemical properties and can have a positive effect on physical and biochemical processes. It is a non-fossil source of carbon. For more info, see video [here](#)

What are the uses of biochar?

There are many uses for biochar as a valuable solid carbon product which can be used in many soil and non-soil applications, many of which can provide carbon sequestration that is stable in the long term.

The many uses of biochar are well documented and supported in scientific literature including:

- Agricultural amendment for improving soils through physical and chemical interactions with soils, nutrients and water.
- Industrial agent for improving physical and chemical properties of materials including concrete, asphalt, industrial inks/paints and resins (e.g. bioplastics).
- Feed additive for livestock to improve health and condition.
- A non-fossil, concentrated carbon source that can substitute for carbon black, activated carbon and other carbon feedstocks used in various industries

See Figure 1. Appendix A for example uses and applications.

It is important to note that any use of biochar which involves combustion or oxidation does not provide CO₂ removal from the atmosphere, importantly however it can still reduce new emissions where fossil fuels are displaced/avoided by its use. Co-products of biochar production also have many uses as an energy source and pyroligneous acid / wood vinegar is a valuable biostimulant in the agricultural industry.

To ensure industry sustainability and benefit, systematic consideration of highest value use of feedstocks, biochar and co-product end uses should be a priority. This includes consideration of climate benefits among many other factors through processes such as triple bottom line assessment (environmental, economic and social).

Recent estimates indicate that biochar could mitigate up to 6.6 Billion tonnes of CO_{2e} globally per year by 2050¹. This is indicatively equivalent to the USA's annual GHG emissions (1990-2019)².

(1) IPCC 6th Assessment Report, March 2022;
(2) UNEP Emissions Gap Report, 2020.

An Introduction to the Roadmap

continued

The UN Sustainable Development Goals (SDG's) are globally recognised by government, non-government and industry organisations to help guide such consideration. Sustainability for the Australian Biochar Industry is a core value of the ANZBIG Code of Practice and the development of further detailed guidance forms part of the initiatives and actions of this Roadmap.

How can biochar be beneficial to mitigating climate change?

Plants grow via photosynthesis using atmospheric CO₂. When plant biomass is turned into biochar, up to half the carbon contained within the feedstock is converted into a solid form of carbon (biochar) which is stable in the long term, effectively removing it from the natural carbon cycle as illustrated in Figure 2. CO₂ Removal (CDR), also referred to as 'drawdown', plays a critical role in combating climate change. When biochar is added to soil it can store carbon in a stable form, locking it away for hundreds or even thousands of years whilst also helping to regenerate degraded soils, with co-benefits. Soil applications typically represent a very high value use of biochar, and in cases such as enhancement of food production can represent the highest value use.

Non-soil applications of biochar also contribute to CO₂ drawdown where the biochar is embodied within long-lived materials and products (e.g. roads, concrete) that will not be combusted or decompose in the short term.

The Biochar Industry in Australia

The Australian biochar industry is in an early growth phase which is seeing the emergence of biochar production facilities in almost all States and Territories of Australia. These include a range of production facilities from small scale to multi-million-dollar investments. Australian biochar equipment companies are also exporting their technologies to Europe, Asia, and the Middle East.

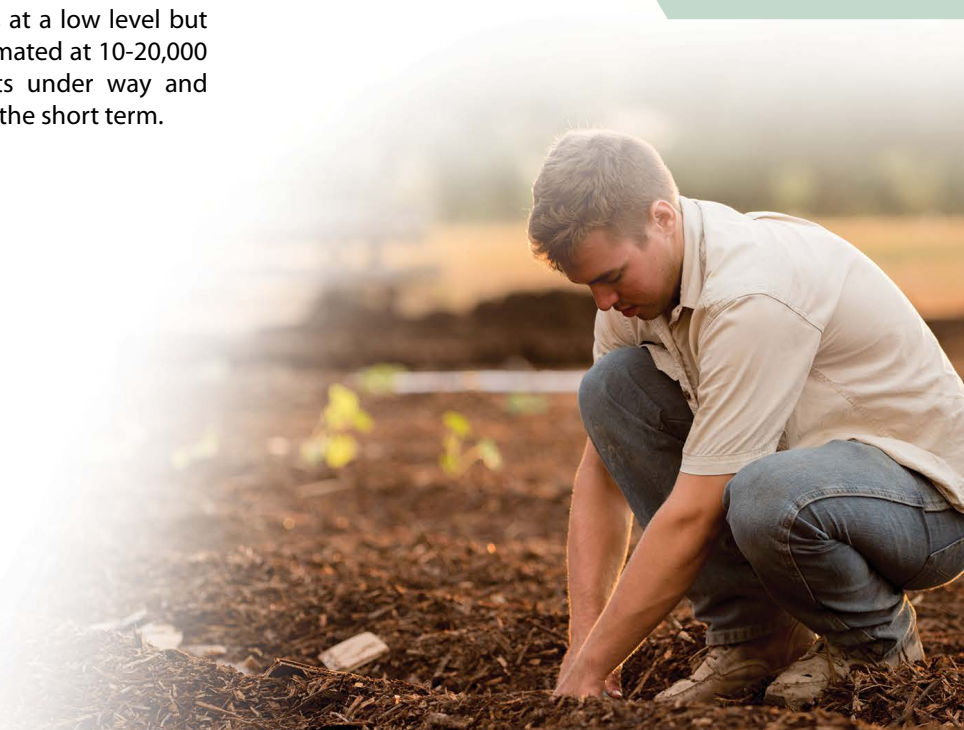
The biochar industry includes the valuable co-products of biochar production including bio-oils, syngas, heat energy and wood vinegar. It also includes the suppliers of biomass and equipment, logistics, value-adding, carbon removal certificate generation, and the end use customers in the biochar industry supply chain.

Biochar scientific research in Australia is active with a number of universities and research institutions actively contributing to global knowledge. There are a number of start-ups and some mature companies actively innovating in the biochar sector.

Current industry estimates indicate that the size of the industry is \$50 – 100 million, with successful scale up expected to increase the industry at least ten fold over the next eight years. This is consistent with overseas trends where industry growth rates of 50% to 60% are being experienced and forecast in the near future.

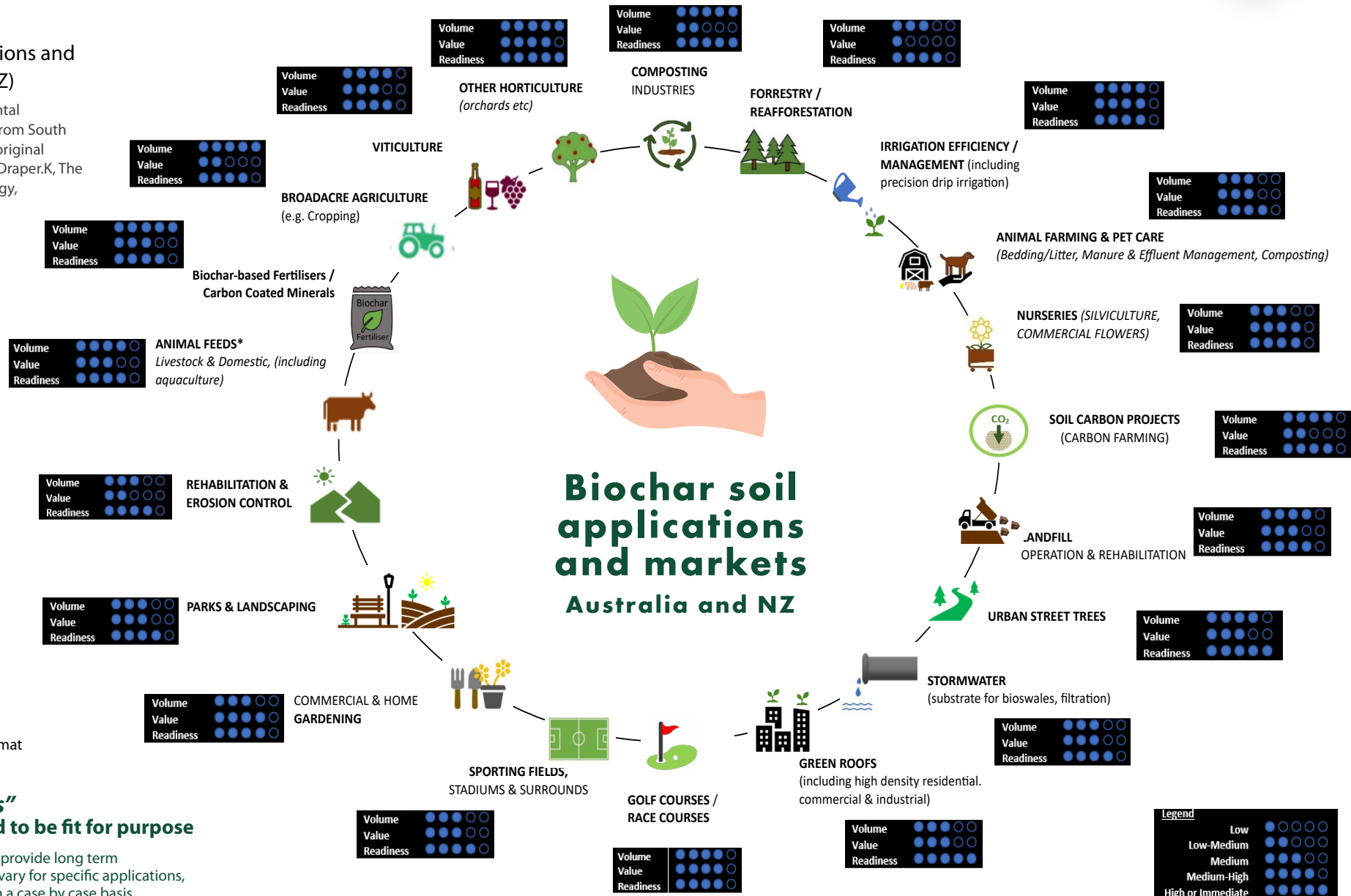
Current Australian biochar production is at a low level but is growing rapidly. As of 2020 it was estimated at 10-20,000 tonnes per annum, with many projects under way and emerging to significantly increase this in the short term.

The vision of ANZBIG is the safe, sustainable and climate positive production of biochar and associated products for the betterment of Australian and New Zealand Society.



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Source: Catalyst Environmental Management with support from South East Water Expanded on an original concept by Ithaka Institute (Draper,K, The Biochar Displacement Strategy, The Biochar Journal, **2016**)

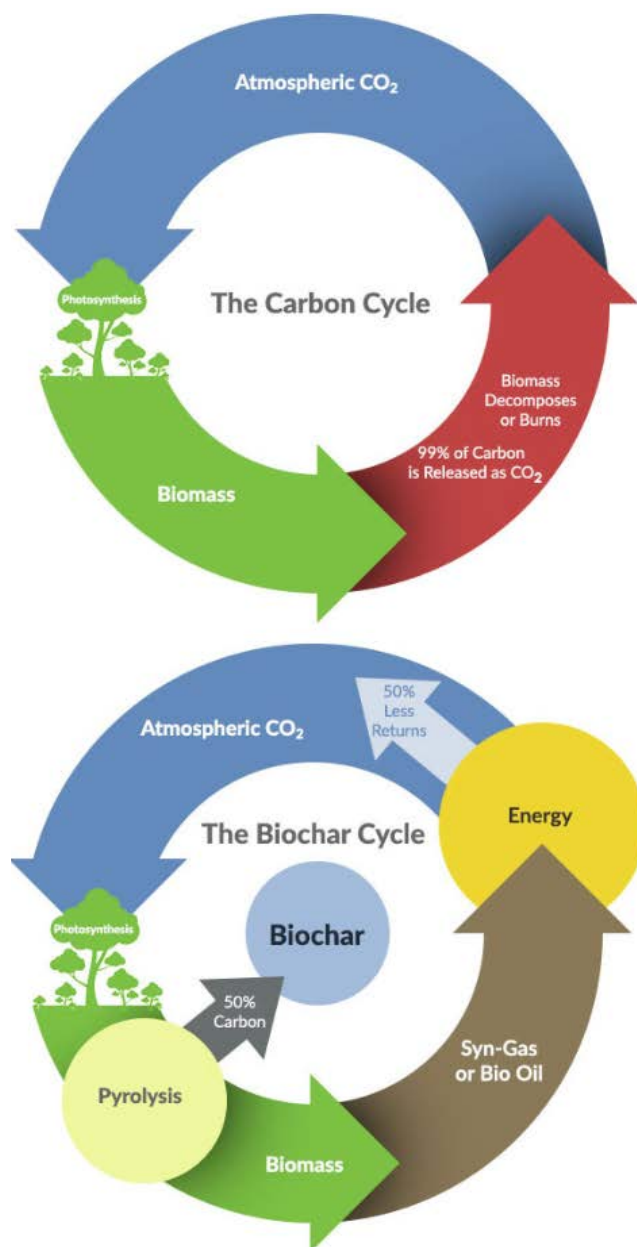


Please note: this document is intended for printing and viewing in A3 landscape format

“Chars Ain’t Chars”

Biochars are tailored to be fit for purpose

Note: Many soil applications provide long term CO₂ Removal (CDR), but can vary for specific applications, which should be assessed on a case by case basis.



Over 99% of CO₂ captured by biomass re-enters our atmosphere as part of the natural carbon cycle.

Pyrolysing wasted plant biomass into biochar **intercepts the cycle** and converts carbon into a form that is typically stable for **centuries to millennia**.

Figure 2.
Biochar CO₂
Removal
(CDR).



SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD



Legend



Direct contributions through
biochar production and use

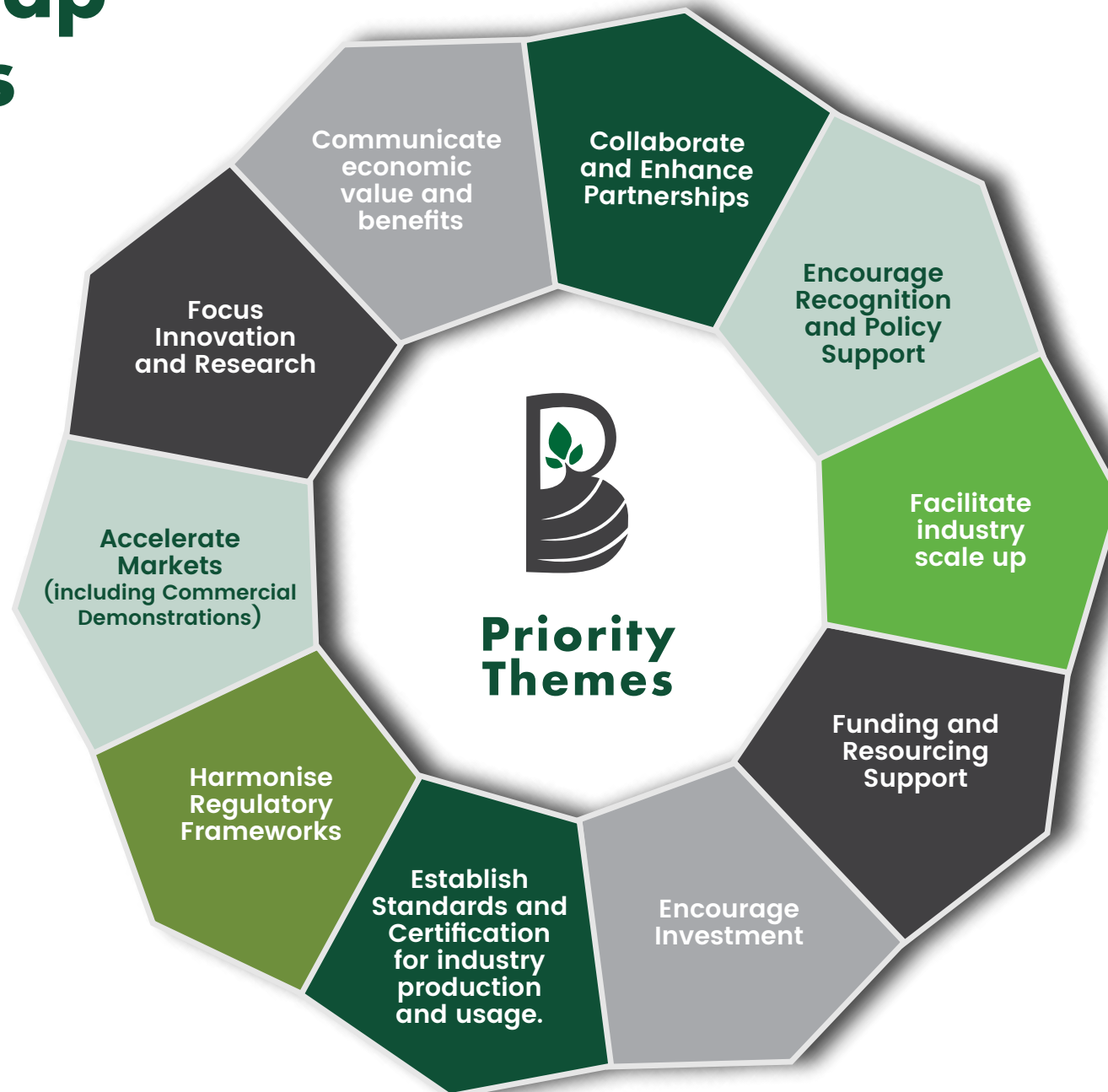


Indirect contributions through
biochar production and use

Figure 3.

Australian biochar can contribute to many of the world's climate and sustainability objectives, including many of the UN Sustainable Development Goals (SDGs).

Roadmap Themes



Initiative 1

Launch the Australian Biochar Industry 2030 Roadmap and fund industry scale up

Context: The Biochar Industry 2030 Roadmap will be a catalyst for growth in the biochar sector. Launching and resourcing the Roadmap's path is critical to build momentum and bring together all key participants. Working groups will be convened Australia-wide to drive and open out the Roadmap.



Action 1.1 Begin nation-wide Roadmap launch and establish forums and working groups across the country

Objective: Co-ordinate and streamline development of the Australian biochar industry

Key Performance Indicators

- Roadmap launched
- Strong pledges of nation-wide support for the Roadmap

Action 1.2 Resource Roadmap management, implementation and governance

Objective: Ensure sufficient resources and systems are in place to deliver the Roadmap

Key Performance Indicators

- Roadmap adequately funded. Proportion of Roadmap funding progress targets achieved (% of targets)
- Tracking system established and annual reporting achieved
- Aligned industries, government and non-government organisations contributing to Roadmap initiatives (financial and in-kind)

Action 1.3 Identify complementary funding opportunities and resources to support scale up

Objective: Ensure sufficient financial resources are available to deliver the Roadmap. Align and compare the Roadmap with current public policy on climate change, agricultural productivity, circular economy, and waste strategy, and advocate for new policies as needed

Key Performance Indicators

- Amount of complementary funding
- Demonstrated incentives, initiatives and policy that support industry scale up

Action 1.4 Measure, monitor and evaluate the scale and growth of the biochar sector

Objective: Understand the success of initiatives to roll out the Roadmap initiatives and actions

Key Performance Indicators

- Deliver annual report on the state of the biochar industry sector in Australia
- Develop and document a monitoring system for measuring performance of Roadmap initiatives and actions



Initiative 2

Improve stakeholder awareness and education of biochar uses and benefits

Context: *Engaging with stakeholders and increasing awareness of biochar is an essential component for the long-term growth of the Australian Biochar Industry. Stakeholders can inform the development of initiatives to ensure the Australian Biochar Industry is taking a targeted and strategic approach to progressing the interests of the industry. As the industry is rapidly expanding, it is also important to continually update stakeholders on recent developments in biochar technology, regulations, products and benefits.*

Action 2.1 Refine biochar sector stakeholder mapping and communications strategy

Objective: Identify key stakeholder required for the expansion of the Australian biochar industry and facilitate connections between these stakeholder and the industry

Key Performance Indicators

- Integration and further stakeholder support
- Stakeholder engagement and communications materials developed/leveraged

Action 2.2 Develop fact/data sheets, videos and other visual communications for biochar and co-products, including applications

Objective: Enable greater access to suitable and relevant resources on the Australian biochar industry and the uses of biochar and co-products. Collaborate with national and international associated groups to accelerate reciprocal knowledge-sharing opportunities and platforms

Key Performance Indicators

- Development of fact/data sheets, videos, and resources for expanding the Australian biochar industry
- Identification of existing resources nationally/globally that can be leveraged or adapted to assist and engage with participants

Action 2.3 Engage with stakeholders regarding biochar and co-product value proposition, including development of technical working groups by industry sector to aid engagement and awareness

Objective: Grow the stakeholders network, and to provide and receive feedback from participants to expand the Australian biochar industry in alignment with participants' expectations and needs

Key Performance Indicators

- Breadth, number and regional extent of stakeholder forums, workshops and events
- Media interest and participants engagement via website, email and other forms of communication

Action 2.4 Grow awareness of ANZBIG Code of Practice for the Sustainable and Safe Production and Use of Biochar and other approved standards

Objective: Ensure awareness of relevant biochar standards for the safe and sustainable production and use of biochar

Key Performance Indicators

- Incorporation of the ANZBIG Code of Practice and other standards in communication with participants
- Training workshops on biochar standards and the Code of Practice
- Engagement with state government agencies across Australia to identify individual requirements additional to the Code of Practice to develop "bridging" guidance and to facilitate ease of industry participation and scale up

Initiative 2

continued

Improve stakeholder awareness and education of biochar uses and benefits



Action 2.5 Develop tools to demonstrate/ evaluate and promote the co-benefits of biochar (including triple-bottom line value)

Objective: Increase the use of biochar products and technology by supporting stakeholders to apply them efficiently and effectively

Key Performance Indicators

- Guidelines for the application and use of biochar for different uses including horticulture, cattle feed, broadscale agriculture and industrial applications
- Published cost benefit analyses of biochar applications

Action 2.6 Integrate Indigenous land knowledge and practices e.g. fire management, into educational and awareness materials

Objective: Acknowledge and support Indigenous knowledge and land practices that relate to biochar use and application

Key Performance Indicators

- Research and document Indigenous land practices related to biochar application and use
- Work with Indigenous groups to exchange knowledge and land practices around biochar use
- Support of Indigenous participation in the biochar industry

Action 2.7 Research industry and community attitudes to biochar

Objective: Understand the success or otherwise of initiatives to improve stakeholder awareness and education

Key Performance Indicators

- Yearly report on stakeholder knowledge of, and attitudes to, the Australian biochar sector



Initiative 3

Integrate and optimise industry and regulatory frameworks

Context: Establishing the reliability of the production and use of biochar and co-products across all uses can accelerate the growth of the Australian Biochar Industry. The relatively novel nature of large-scale manufacturing and use of biochar and biochar co-products means existing regulations require review and revision as the industry grows and the range of potential biochar applications increases.



Action 3.1 Identify existing barriers and potential regulatory approaches to harmonise and facilitate safe and sustainable operation across the Australian biochar industry

Objective: Optimise the regulatory and procedural framework for biochar to maximise benefits and reduce risks

Key Performance Indicators

- Conduct mapping exercise with stakeholders and partners which identifies regulatory and procedural barriers, and identifies remedies or alternative strategies

Action 3.2 Develop sustainability assessment guidance, including higher order use, for biochar feedstocks and end-use applications

Objective: Ensure feedstocks for biochar production are suitable for use

Key Performance Indicators

- Development of biochar feedstock sustainability assessment guidelines to integrate with the Biochar Code of Practice

Action 3.3 Consult with federal and state government departments and key stakeholders to address biochar barriers and market uncertainties

Objective: Engage with key stakeholders to ensure barriers are reduced and incentives increased to scale up sustainable biochar production and use

Key Performance Indicators

- Identification and consistent engagement with key government and non-government stakeholders



Initiative 4

Support biochar commercial demonstrations and trials

Context: The results of commercial demonstrations and trials can increase confidence in the industry and open avenues for potential investment and scale up. Such activities can assist in the development of regulation, certification schemes, and application, or manufacture methodologies.



Action 4.1 Demonstrate broad acre soil applications at a significant scale

Objective: Increase economic confidence in large-scale agricultural applications of biochar within Australia

Key Performance Indicators

- Outline criteria and seek expressions of interest for broad acre demonstration partners
- Establishment and documentation of broad acre trials and demonstrations

Action 4.2 Demonstrations to regenerate marginal /degraded land, including mine site rehabilitation

Objective: Increase economic confidence in the use of biochar as a remediation technology within Australia

Key Performance Indicators

- Outline criteria and seek expressions of interest from rehabilitation / remediation demonstration partners
- Establishment and documentation of rehabilitation / remediation demonstrations

Action 4.3 Support commercial-scale demonstration projects for non-broad acre soil applications of biochar

Objective: Increase economic confidence in many other soil applications of biochar, and to showcase the diversity of Australian soil-based industries with their potential to benefit from biochar and co-products

Key Performance Indicators

- Outline criteria and seek expressions of interest for potential demonstration partners
- Establishment and documentation of demonstration and trial projects

Action 4.4 Support commercial scale demonstration projects for non-soil industrial applications

Objective: Increase economic confidence in non-soil based applications of biochar and showcase the diversity of Australian industries with potential to benefit from biochar and co-products

Key Performance Indicators

- Outline criteria and seek expressions of interest for potential demonstration partners
- Establishment of demonstration projects

Action 4.5 Support co-pyrolysis demonstrations of plant biomass, biosolids, forestry residues, agricultural residues and food organics / garden organics (FOGO).

Objective: Increase economic confidence in utilising co-pyrolysis as a waste to value/resource management strategy to benefit from biochar and co-products

Key Performance Indicators

- Outline criteria and seek expressions of interest for potential demonstration partners
- Establishment of co-pyrolysis demonstration projects

Initiative 5

Leverage carbon emission reduction and CO₂ removal opportunities

Context: The growth of the Australian biochar industry can be rapid if appropriately encouraged. Initiatives must be strategic, and opportunities taken to maximise benefits and optimise both emission reduction (ER) and CO₂ removal (CDR).



Action 5.1 Promote inclusion of recognised accounting methods for biochar in national greenhouse gas emissions (GHG) inventories

Objective: Enable immediate contribution of biochar to national GHG emission inventories by using readily available IPCC accounting methodology for biocharⁱ in the calculations

Key Performance Indicators

- Adoption of biochar in Australia's national GHG emissions inventory
- Adoption of biochar in national GHG emissions inventories of other countries

(i) Intergovernmental Panel on Climate Change (IPCC), 2019, Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 4: Agriculture, Forestry and Other Land Use; Appendix 4: Method for Estimating the Change in Mineral Soil Organic Carbon Stocks from Biochar Amendments

Action 5.2 Develop biochar methodologies under Australia's Emissions Reduction Fund (ERF) for all soil uses and non-soil/industrial uses

Objective: Align biochar methodologies with the Australian ERF to support accreditation of emissions reduction and CO₂ removal using biochar

Key Performance Indicators

- Identification of the appropriate expert teams capable of developing biochar application methodologies for both soil, and non-soil/industrial uses, in accordance with the Australian ERF
- Development and implementation of work plans to prepare biochar application methodologies for soil and non-soil/industrial uses
- Acceptance of biochar production and use methodologies in soil and non-soil/industrial applications under the ERF

Action 5.3 Support development of a biochar method for feed chars to reduce methane from livestock under Australia's Emissions Reduction Fund (ERF)

Objective: Use biochar to accelerate climate action on critical livestock emissions in agriculture

Key Performance Indicators

- Support research initiatives showing the effect of feed chars on methane reduction
- Use positive research to develop methodology for this biochar application

Action 5.4 Collaborate with stakeholders with net zero or other carbon reduction targets to raise awareness of biochar's potential role in carbon drawdown

Objective: Build confidence in the Australian biochar production industry as a net zero technology

Key Performance Indicators

- Provision of biochar net zero awareness workshops
- Engagements with industry, promoting emission reduction and carbon drawdown initiatives

Action 5.5 Support biochar inclusion into Integrated Assessment Modelling

Objective: Facilitate the endorsement of biochar as a pillar technology in international strategies to combat climate change

Key Performance Indicators

- Support of existing efforts to include biochar in the Integrated Assessment Modelling domestically and abroad

Initiative 6

Encourage beneficial use of residual or waste biomass

Context: Large quantities of residual or waste biomass are being sent to landfill or are being burned leading to increased global GHG emissions. Over 3% of global GHG emissions are derived from agricultural residues. Much of this waste biomass could be diverted to the biochar industry for change into biochar and co-products, reducing the potential for the release of harmful GHGs into the atmosphere.

Action 6.1 Support the diversion from landfilling and uncontrolled burning of clean biomass

Objective: To utilise biomass residues more productively in Australia through conversion to biochar

Key Performance Indicators

- The amount of biomass diverted from landfill and not burned in an uncontrolled environment
- The continued development and commercial application of Australian technology for biomass residue conversion to biochar
- Policy developments that encourage use of biomass residues for biochar production and use

Action 6.2 Further encourage circular production of residual biomass to biochar

Objective: Incentivise through both emissions reduction methodologies, and penalties for uncontrolled burning, the transformation of waste and residual biomass to biochar

Key Performance Indicators

- Assessments and studies on the viability of further incentivising the circular production of residual biomass in Australia
- Establishment of emission reduction methodologies for biomass conversion to biochar

Action 6.3 Enhance and maintain biomass availability assessment tools to aid industry capacity to grow by reliably quantifying and sourcing sustainable biomass

Objective: Identify reliable biomass feedstocks that can facilitate biochar industry growth

Key Performance Indicators

- Quantification of residual biomass opportunities for biochar in every state and territory of Australia-
- Create industry specific biomass assessment tools

Action 6.4 Create a grading system for residual waste biomass to improve economic evaluation, and the safe use and production of biochar

Objective: To categorise potential biomass feedstocks to facilitate safe and sustainable use for biochar production

Key Performance Indicators

- Consultation with industry stakeholders including residual biomass producers, to establish a suitable grading system for residual biomass
- Establishment of a guideline on assessing suitability of residual biomass for biochar production



Initiative 7

Drive beneficiation and increased value of biochar products and co-products

Context: Carbon is a very valuable component of our society and has many different uses. Much of this carbon including carbon black and activated carbon is derived from fossil carbon sources. Biochar can provide an alternative high value component for many uses.



Action 7.1 Fund research into beneficial upgrading of biochar products

Objective: Increase biochar value by identifying specialty biochar products and uses

Key Performance Indicators

- Number of new biochar-related products entering the market
- Number of biochar-related patents being registered by Australian companies, organisations, and individuals

Action 7.2 Research and evaluate biochar substitution in traditional carbon markets

Objective: Facilitate the establishment of biochar as a replacement material for fossil derived carbon markets

Key Performance Indicators

- Uptake of biochar in traditional fossil carbon markets

Action 7.3 Drive technical and economic outcomes of co-products from biochar production (e.g. energy, hydrogen and wood vinegar)

Objective: Optimise the economic and environmental benefits of biochar production in Australia through development and commercialisation of co-technologies and products

Key Performance Indicators

- Number of new biochar related co-products entering the market
- Number of biochar co-product patents being registered by Australian companies, organisations, and individuals

Action 7.4 Establish sequestration and downstream emissions avoidance potential for different applications of biochar using different feedstocks

Objective: Maximise the carbon drawdown potential of biochar through establishing strong frameworks for understanding carbon sequestration potential of different applications

Key Performance Indicators

- Number of industry-accepted papers and guidance materials on carbon sequestration potential for different applications and feedstocks



Initiative 8

Safeguard responsible use and production of biochar

Context: To build a strong biochar industry it is crucial that there are appropriate safeguards to ensure that the production and use of biochar is done safely and sustainably. The industry should help drive those standards and regulations to ensure the necessary safeguards are developed and certified, resulting in strong economic, social and environmental protections.



Action 8.1 Fast-track the implementation of the ANZBIG Code of Practice and biochar certification for particular uses

Objective: Develop and implement the *Code of Practice for the Safe and Sustainable Production and Use of Biochar in Australia*

Key Performance Indicators

- Certified biochar production sites using the Code of Practice
- Certification of safe and sustainable biochar production linked to biochar-based emissions trading
- Development of branded certified biochar in Australia
- Recognition of the Code of Practice by regulatory authorities

Action 8.2 Provide support for integration with other standards for sustainable sourcing and use of biomass

Objective: Ensure sustainable biomass sourcing by linking with other existing programs and initiatives identifying sustainable biomass production and use

Key Performance Indicators

- Identification and verification of existing biomass certification schemes for applicability to biochar production and use
- Support for biochar producers in sustainable feedstock procurement through provision of suitable information

Action 8.3 Develop guidance for rate-based application of biochar in soil applications including supporting research and demonstration

Objective: Ensure consumers receive maximum benefit from biochar in soil applications

Key Performance Indicators

- Development of guidance material for biochar application rates for different soil and use applications

Action 8.4 Develop a long-term self-funding mechanism for safeguarding the ongoing development of the biochar sector such as through a certification levy

Objective: Safeguard the economic future of the Australian biochar industry to ensure sustained future industry collaboration and growth

Key Performance Indicators

- Undertake annual progress reviews of long-term funding needs and strategies to self-sustain the support and growth of the biochar industry



Initiative 9

Support government utility and industry procurement practices

Context: Australian governments: federal, state, territory and local, have enormous influence on procurement through tendering and procurement practices. Governments are also custodians of many biomass resources and collection services. The benefits of biochar for circular economy and climate change mitigation should be encouraged in suitable opportunities and existing barriers removed.



Action 9.1 Identify and promote replacement or for fossil derived carbon

Objective: Ensure that biochar is considered for suitable public and industrial applications and as a substitute or replacement for fossil fuel derived carbon

Key Performance Indicators

- Number of alternate uses and new applications for biochar
- Total biochar use in different industry and government applications
- Number of policy initiatives implemented by governments to support industry scale up such as incentives, grants and levies

Action 9.2 Establish biochar specifications for key procurement and use opportunities and identify carbon sequestration potential of these applications

Objective: Establish biochar specifications for key procurement and use opportunities and identify their carbon sequestration potential

Key Performance Indicators

- Development of biochar specifications and guidelines for use in different public and industrial use

Action 9.3 Develop biochar case studies and a biochar reference library for government and industry

Objective: Ensure that government agencies and industry are aware of how best to use biochar in a range of applications

Key Performance Indicators

- Biochar case studies generated per year
- Use of case studies and library visits measured by downloads and site visits



Initiative 10

Drive export of Australian biochar innovation internationally

Context: The Australian biochar industry is making a strong contribution to the global biochar industry in production technologies, applications and biochar research. The further growth of the industry has the potential to increase Australia's contribution to UN Sustainable Development Goals including climate action.



Action 10.1 Link with Australian federal and state trade export and overseas collaboration initiatives

Objective: Ensure the Australian biochar industry has a strong international network and is well placed for international trade opportunities

Key Performance Indicators

- Interaction with Australian and overseas trade initiatives and establishment of collaborative initiatives
- Successful export of Australian biochar technology and expertise

Action 10.2 Link with other global biochar initiatives such as IBI, EBIC, USBI and BNZ to exchange information and influence policy

Objective: Bring a co-ordinated and streamlined approach to the development of the global biochar industry reflecting the Australian perspective

Key Performance Indicators

- Attendance and presentations at global biochar forums and gatherings
- Strong participation as a member of IBI, an affiliate of EBIC and a supporter of BNZ

Action 10.3 Identify biochar production and use as part of Australia's global climate change contribution

Objective: Ensure that the actions and activities that are contributing to biochar carbon drawdown in Australia and through Australian activities elsewhere are articulated both domestically and internationally to key stakeholders

Key Performance Indicators

- Number of international climate change forums where the Australian biochar industry is prominent
- Number of publications, papers, presentations, and website hits related to biochar carbon drawdown activities



Concluding Remarks

The Australian Biochar Industry Roadmap identifies the actions required to scale up rapidly from an Australian industry valued in excess of \$50 million today to a multibillion dollar industry in 2030 (estimated to be at least \$1 - \$5 billion per annum).

By doing this we will turn wasted resources into valuable carbon and energy products for agriculture and industry and in the process generate jobs, economic opportunities and sequester carbon.

The growth of the Australian Biochar Industry is in a pivotal alignment with rapidly increasing global action on climate change, both in reducing or avoiding new emissions and critically removing excess CO₂ already built up in the atmosphere.

Successful implementation of this Biochar Roadmap by 2030 has the potential to reduce Australia's current net carbon emissions by 10-15 % provide up to 20,000 permanent jobs (including in regional and rural areas), improve soil health and agricultural productivity and return degraded lands to a higher value.

This significant scale up is achievable and indeed necessary to generate the climate change and circular economy needs of our society.

A concerted effort in all parts of the economy whether it be industry and its affiliates, land management, capital, all levels of government and from research will collectively achieve, and benefit from, the implementation of this Roadmap.

Delivering this Roadmap will enable Australia to make a significant contribution to an emerging global industry and help us deliver our global climate change commitments.

Be a part of the growing biochar industry in Australia

Join The Australian Biochar Pledge at anzbig.org/biochar-industry-2030-roadmap

"We pledge to build a safe and sustainable biochar industry in Australia.

We know that valuable Australian biomass resources are being wasted each year which could be converted to energy and bioproducts that count towards Australia's Net Zero Economy.

We know that a scale up of the sustainable production and use of biochar will boost the Australian Net Zero Economy significantly.

We pledge to support ANZBIG in delivering the Australian 2030 Biochar Industry Roadmap for all Australians."

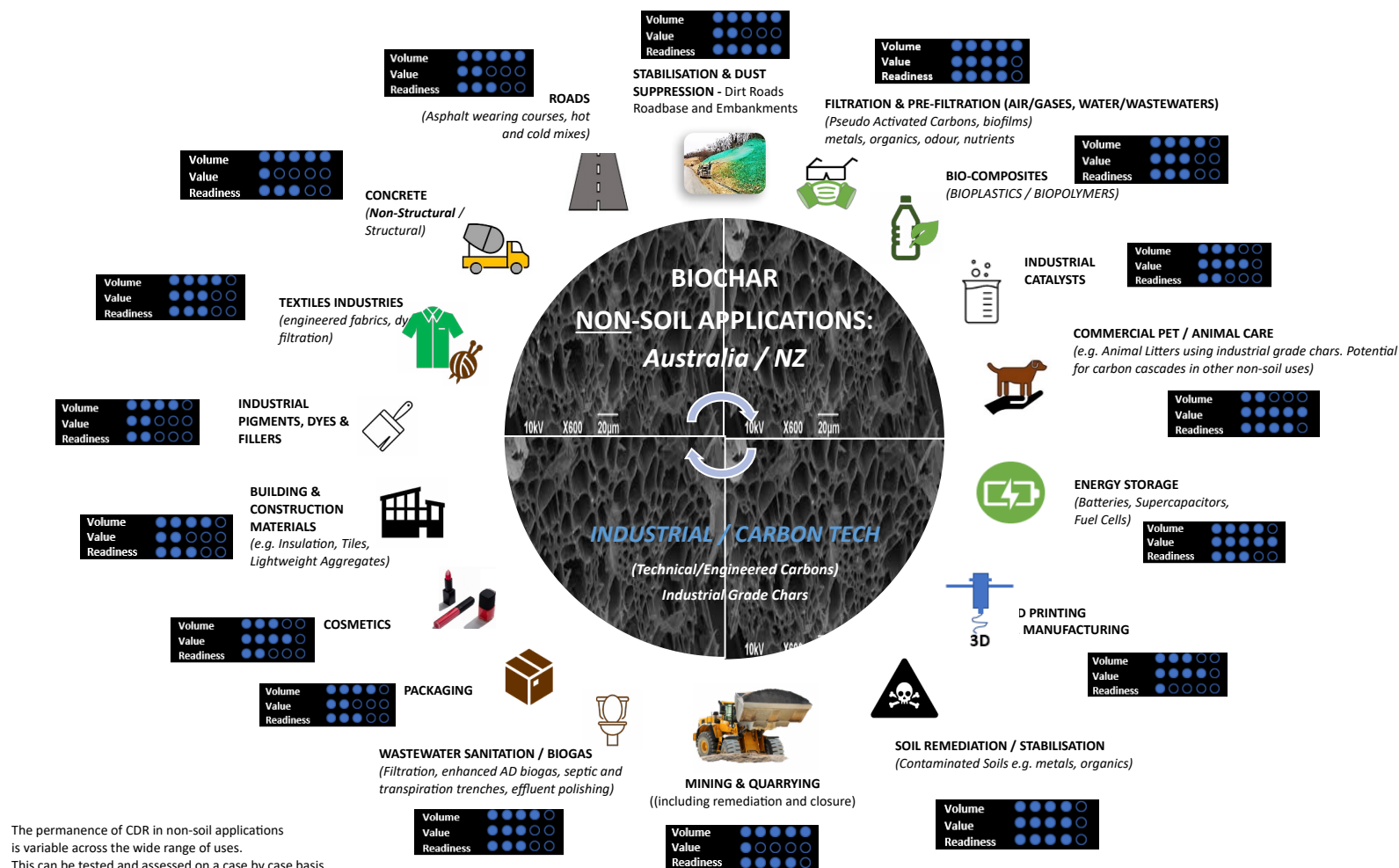


ANZBIG welcomes new members through our portal at www.anzbig.org/membership

Other Non-Soil Uses of Biochar and Biocarbons

Figure 1. Biochar Non-Soil Applications and Markets (Australia/NZ) – Industrial / Carbon Tech

Source: Catalyst Environmental Management with support from South East Water Expanded on an original concept by Ithaka Institute (Draper,K, The Biochar Displacement Strategy, The Biochar Journal, [2016](#))



Please note: this document is intended for printing and viewing in A3 landscape format

Legend	Low	Low-Medium	Medium	Medium-High	High or Immediate
Volume	●	●	●	●	●
Value	●	●	●	●	●
Readiness	●	●	●	●	●

"Chars Ain't Chars"....

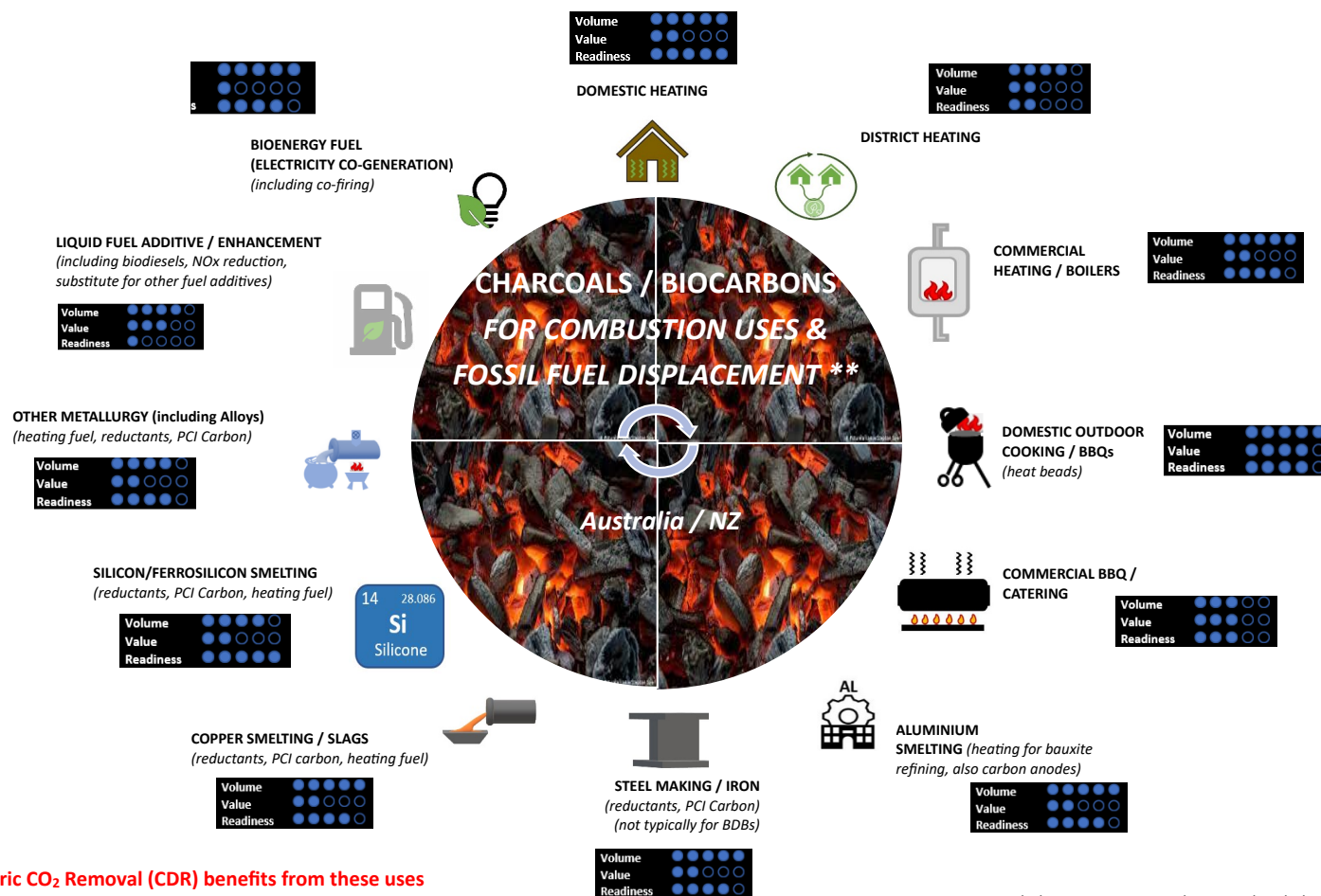
Biochars for Non-Soil Applications are engineered to be *Fit for Purpose*. They should be sustainably sourced and consider optimal use of available biomass resources and optimal use of land (including biomass cropping).

Expanded upon on an original concept by Ithaka Institute 2016
(Draper,K: The Biochar Displacement Strategy,

Other Non-Soil Uses of Biochar and Biocarbons

Figure 2. Charcoals/Biocarbons for Combustion Uses and Fossil Fuel Displacement

Source: Catalyst Environmental Management with support from South East Water Expanded on an original concept by Ithaka Institute (Draper.K, The Biochar Displacement Strategy, The Biochar Journal, [2016](#))



**** No atmospheric CO₂ Removal (CDR) benefits from these uses**

(typically no CDR ('drawdown') when chars are burned/oxidized).

However, potentially significant **reductions** in additional/new emissions may be achieved via displacement of fossil carbon (i.e. avoided fossil emissions), pending LCA.

Expanded upon on an original concept by Ithaka Institute 2016
(Draper.K: The Biochar Displacement Strategy, the Biochar Journal Nov [2016](#))

Please note: this document is intended for printing and viewing in A3 landscape format



"Chars Ain't Chars"....

Biocarbons used to displace fossil fuels are typically tailored *Fit for Purpose*. They should be *sustainably sourced*, and should consider optimal use of available biomass resources and optimal use of land (including biomass cropping).

APPENDIX B

Australian Biochar Industry 2030 Roadmap - Key Initiatives and Supporting Actions Summary Table

Scaling Biochar and Carbon Sequestration in Australia to a Multi Billion Dollar Industry by 2030

KEY INITIATIVES & SUPPORTING ACTIONS		OBJECTIVES	KEY PERFORMANCE INDICATORS	Aligned UN SDGs	Aligned Roadmap Priority Themes	TIMING			KEY BENEFITS					
						Short Term	Mid Term	Long Term	Regulator Confidence	User Confidence	ESD / Climate	Economic Value	Social Licence	Market Growth
1 Launch the Australian Biochar Industry 2030 Roadmap and fund industry scale up														
1.1	Begin nation-wide Roadmap launch and establish forums and working groups across the country.	Coordinate and streamline development of the Australian biochar industry.	1. Roadmap launched. 2. Strong pledges of nation-wide support for the Roadmap.	8 DECENT WORK AND ECONOMIC GROWTH	Communicate Economic Value & Benefits	✓			✓	✓	✓	✓	✓	
1.2	Resource Roadmap management, implementation and governance.	Ensure sufficient resources and systems are in place to successfully deliver the Australian Biochar Industry Roadmap	1. Roadmap adequately funded. Proportion of Roadmap funding progress targets achieved (% of targets). 2. Tracking system establishment and annual reporting achieved. 3. Aligned industries, government and non-government organisations contributing to Roadmap initiatives (financial and in-kind).	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE		✓	✓	✓	✓	✓	✓	✓		
1.3	Identify complementary funding opportunities and sources to support scale up.	Ensure sufficient financial resources are available to deliver the Roadmap. Align and compare the Roadmap with current policy on climate change, agricultural productivity, circular economy, waste strategy and advocate for new policies as needed.	1. Amount of complementary funding. 2. Demonstrated incentives, initiatives and policy that support industry scale up	11 SUSTAINABLE CITIES AND COMMUNITIES			✓							
				12 RESPONSIBLE CONSUMPTION AND PRODUCTION		Actively Seek Funding & Resourcing	✓	✓						
1.4	Measure, monitor and evaluate the scale and growth of the biochar sector.	Understand the success of initiatives to roll out the Roadmap initiatives and actions.	1. Deliver Annual report on the state of the biochar industry sector in Australia. 2. Develop and document a monitoring system for measuring performance of Roadmap initiatives and actions	13 CLIMATE ACTION 17 PARTNERSHIPS FOR THE GOALS	Encourage Investment	✓	✓	✓	✓	✓	✓	✓		
2 Improve stakeholder awareness and education of biochar uses and benefits														
2.1	Refine biochar sector stakeholder mapping and communications strategy.	Identify key stakeholders required for the expansion of the Australian Biochar Industry and facilitate connections between these stakeholders and the industry.	1. Integration and further stakeholder support. 2. Stakeholder engagement and communications materials developed/leveraged.	8 DECENT WORK AND ECONOMIC GROWTH	Communicate Economic Value & Benefits	✓	✓		✓			✓	✓	
2.2	Develop data sheets and videos on biochar and co-product applications.	Enable greater access to suitable and relevant resources on the Australian Biochar Industry and the uses of biochar and co-products. Collaborate with national and international associated groups to accelerate reciprocal knowledge-sharing opportunities and platforms	1. Development of fact/data sheets, videos, and resources for expanding the Australian Biochar Industry. 2. Identification of existing resources nationally/globally that can be leveraged or adapted to assist and engage with stakeholders.	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	Collaborate & Enhance Partnerships									
2.3	Engage with stakeholders regarding biochar and co-product value proposition, including development of technical working groups by industry sector to aid engagement and awareness.	Grow the stakeholder network, and to provide and receive feedback from stakeholders to expand the Australian biochar industry in alignment with stakeholder expectations and needs.	1. Breadth, number and regional extent of stakeholder forums, workshops and events. 2. Media interest and stakeholder engagement via website, email and other forms of communication.	11 SUSTAINABLE CITIES AND COMMUNITIES	Encourage Recognition & Policy Support	✓	✓		✓		✓	✓	✓	
				12 RESPONSIBLE CONSUMPTION AND PRODUCTION	Facilitate Industry Scale Up	✓	✓	✓		✓	✓	✓		
2.4	Grow awareness of ANZBIG Code of Practice for the Sustainable and Safe Production and Use of Biochar and approved standards.	Ensure awareness of relevant biochar standards for the safe and sustainable production and use of biochar.	1. Incorporation of the ANZBIG Code of Practice and other standards in communication with stakeholders. 2. Training workshops on Biochar standards and the Code of Practice. 3. Engagement with State government agencies across Australia to identify individual requirements additional to the Code of Practice to develop "bridging" guidance where required to facilitate ease of industry participation and scale up.	13 CLIMATE ACTION	Actively Seek Funding & Resourcing	✓	✓		✓	✓	✓	✓	✓	
2.5	Develop tools to demonstrate/evaluate and promote the co-benefits of biochar (including triple-bottom line value).	Increase the use of biochar products and technology by facilitating stakeholders to efficiently and correctly apply biochar and co-products.	1. Guidelines for the application and use of biochar for different uses including horticulture, cattle feed, broadscale agriculture and industrial applications. 2. Published cost benefit analyses of biochar applications.	17 PARTNERSHIPS FOR THE GOALS	Encourage Investment	✓	✓							
2.6	Integrate indigenous land knowledge and practices (e.g. fire management) into biochar educational and awareness materials.	Acknowledge and support Indigenous knowledge and land practices that relate to biochar use and application.	1. Research and document indigenous land practices related to biochar application and use. 2. Work with indigenous groups to exchange knowledge and land practices around biochar use. 3. Support indigenous participation in the biochar industry.		Instill Confidence	✓	✓			✓		✓		
2.7	Research industry and community attitudes to biochar.	Understand the success or otherwise of biochar initiatives to improve stakeholder awareness and education.	1. Yearly report on stakeholder knowledge of, and attitudes to, the Australian biochar sector.		Focus Innovation & Research	✓	✓	✓				✓	✓	
3 Integrate and optimise industry and regulatory frameworks														
3.1	Identify existing barriers and potential regulatory approaches to harmonise and facilitate safe and sustainable industry operation across Australia.	Optimise the regulatory and procedural framework around biochar to maximise benefits and reduce risks.	1. Conduct mapping exercises with stakeholders and partners which identifies regulatory and procedural barriers, and identifies remedies or alternative strategies.	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	Communicate Economic Value & Benefits	✓	✓		✓	✓		✓	✓	
3.2	Develop sustainability assessment guidance (including addressing higher order use) for biochar feedstocks and end-use applications.	Ensure feedstocks for biochar production are suitable for use.	1. Development of biochar feedstock sustainability assessment guidelines to integrate with the Biochar Code of Practice.	11 SUSTAINABLE CITIES AND COMMUNITIES										
				12 RESPONSIBLE CONSUMPTION AND PRODUCTION	Collaborate & Enhance Partnerships	✓								
3.3	Consult with federal and state government departments and key stakeholders to address biochar barriers and market uncertainties.	Engage with key stakeholders to ensure barriers are reduced and incentives increased to scale up biochar production and use.	1. Identification and consistent engagement with key government and non-government stakeholders.	13 CLIMATE ACTION 17 PARTNERSHIPS FOR THE GOALS	Encourage Recognition & Policy Support	✓	✓		✓	✓	✓	✓	✓	

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KEY INITIATIVES & SUPPORTING ACTIONS		OBJECTIVES	KEY PERFORMANCE INDICATORS	Aligned UN SDGs	Aligned Roadmap Priority Themes	TIMING			KEY BENEFITS					
						Short Term	Mid Term	Long Term	Regulator Confidence	User Confidence	ESD / Climate	Economic Value	Social Licence	Market Growth
4 Support biochar commercial demonstrations and trials														
4.1	Support demonstration for broadacre soil applications at a significant scale.	Increase economic confidence in large-scale agricultural applications of biochar within Australia.	1. Outline criteria and seek expression of interest for potential broadacre demonstration partners. 2. Establishment of broadacre demonstrations.	2 ZERO HUNGER 6 CLEAN WATER AND SANITATION	Communicate Economic Value & Benefits	✓	✓		✓	✓		✓		✓
4.2	Support demonstrations to regenerate marginal or degraded land, including mine site rehabilitation.	Increase economic confidence in the use of biochar as a rehabilitation and remediation technology within Australia.	1. Outline criteria and seek expressions of interest for potential rehabilitation / remediation demonstration partners 2. Establishment of rehabilitation/remediation demonstrations.	8 DECENT WORK AND ECONOMIC GROWTH	Collaborate & Enhance Partnerships	✓	✓	✓	✓	✓		✓		✓
4.3	Support commercial scale demonstration projects for non-broadacre soil applications of biochar.	Increase economic confidence in many other soil applications of biochar, and to showcase the diversity of Australian soil-based industries with potential to benefit from biochar and co-products.	1. Outline criteria and seek expressions of interest for potential demonstration partners. 2. Establishment of demonstration and trial projects.	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 11 SUSTAINABLE CITIES	Facilitate Industry Scale Up	✓	✓		✓	✓	✓	✓	✓	✓
4.4	Support commercial scale demonstration projects for non-soil industrial applications of biochar.	Increase economic confidence in non-soil based applications of biochar and showcase the diversity of Australian industries with potential to benefit from biochar and co-products.	1. Outline criteria and seek expressions of interest for potential demonstration partners. 2. Establishment of demonstration projects.	12 RESPONSIBLE CONSUMPTION AND PRODUCTION 13 CLIMATE ACTION	Encourage Investment Instill Confidence	✓	✓		✓	✓	✓	✓	✓	✓
4.5	Support co-pyrolysis demonstrations of plant biomass, biosolids, forestry residues, agricultural residues and food organics / garden organics (FOGO).	Increase economic confidence in utilising co-pyrolysis as a waste to value/resource management strategy.	1. Outline criteria and seek expressions of interest for potential demonstration partners. 2. Establishment of co-pyrolysis demonstration projects.	17 PARTNERSHIPS FOR THE GOALS	Focus Innovation & Research	✓			✓	✓	✓	✓	✓	✓
5 Leverage Carbon Emission Reduction and CO ₂ Removal opportunities.														
5.1	Promote inclusion of recognised accounting methods for biochar in National GHG Emissions Inventories <i>(IPCC-2019¹ recommended method for estimating change in mineral Soil Organic Carbon Stocks from biochar amendments).</i>	Enable immediate contribution of biochar to national GHG emission inventories through inclusion of the readily available IPCC accounting method for biochar in the calculations.	1. Adoption of biochar in Australia's National GHG Emissions Inventory 2. Adoption of biochar in national GHG emissions inventories of other countries	13 CLIMATE ACTION 11 SUSTAINABLE CITIES AND COMMUNITIES 12 RESPONSIBLE CONSUMPTION AND PRODUCTION 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 8 DECENT WORK AND ECONOMIC GROWTH	Communicate Economic Value & Benefits									
5.2	Develop biochar methodologies under Australia's Emissions Reduction Fund (ERF) for all soil uses and non-soil/industrial uses.	Align biochar method(s) for soil and non-soil/industrial uses with the Australian ERF to support crediting of both emissions reduction and CO ₂ Removal provided through production and use of biochar.	1. Identification of the appropriate expert team capable of developing biochar methods for soil uses in accordance with the Australian ERF. 2. Identification of the appropriate expert team capable of developing biochar methods for non-soil/industrial uses in accordance with the Australian ERF. 3. Development and implementation of work plans to prepare biochar methods for soil and non-soil/industrial uses. 4. Acceptance of biochar soil use and non-soil/industrial use methodologies under the ERF.		Collaborate & Enhance Partnerships	✓			✓	✓	✓	✓		✓
					Facilitate Industry Scale Up									
					Encourage Recognition & Policy Support	✓			✓	✓	✓	✓		✓
					Encourage Investment	✓								
5.4	Collaborate with stakeholders with Net Zero or other carbon reduction targets to help raise awareness of biochar's potential role in carbon drawdown.	Increase economic, public and industry confidence in the Australian biochar production industry as a Net Zero technology	1. Provision of biochar Net Zero awareness workshops. 2. Engagements with industry initiatives promoting emission reduction and carbon drawdown.	Instill Confidence	✓	✓	✓		✓	✓	✓	✓	✓	
5.5	Support biochar inclusion into the Integrated Assessment Modelling.	Facilitate the adoption of biochar as a pillar technology in international strategies to combat climate change.	1. Support of existing efforts to include biochar in the Integrated Assessment Modelling domestically and abroad.	Harmonise Regulatory Frameworks	✓	✓			✓	✓	✓	✓	✓	
6 Encourage beneficial use of residual or waste biomass														
6.1	Support the diversion from landfilling and uncontrolled burning of clean biomass.	To utilise biomass residues more productively in Australia through conversion to biochar.	1. The amount of biomass diverted from landfill and not burned in an uncontrolled environment. 2. The continued development and commercial application of Australian technology for biomass conversion to biochar. 3. Policy developments that encourage use of biomass residues for biochar production and use.	8 DECENT WORK AND ECONOMIC GROWTH 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	Communicate Economic Value & Benefits	✓	✓	✓	✓	✓		✓		✓
6.2	Further incentivise circular production of residual biomass to biochar.	Incentivise through both emissions reduction methodologies and penalties for uncontrolled burning, the transformation of waste and residual biomass to biochar.	1. Assessments and studies on the viability of further incentivising the circular production of residual biomass in Australia. 2. Establishment of emission reduction methodologies for biomass conversion to biochar	11 SUSTAINABLE CITIES AND COMMUNITIES	Facilitate Industry Scale Up	✓	✓		✓	✓	✓	✓	✓	✓
6.3	Enhance and maintain biomass availability assessment tools to aid industry capacity to grow by reliably quantifying and sourcing sustainable biomass.	Identify reliable biomass feedstocks that can facilitate biochar industry growth.	1. Quantify residual biomass opportunities for biochar in every state and territory of Australia. 2. Create industry specific biomass assessment tools.	12 RESPONSIBLE CONSUMPTION AND PRODUCTION 13 CLIMATE ACTION	Encourage Recognition & Policy Support Encourage Investment	✓	✓							
6.4	Create a grading system for residual biomass to improve economic evaluation, and the safe use and production of biochar.	To categorise potential biomass feedstocks to facilitate safe and sustainable use for biochar production.	1. Consultation with industry stakeholders including residual biomass producers to establish a suitable grading system for residual biomass 2. Establishment of a guideline on assessing suitability of residual biomass for biochar production	15 LIFE ON LAND	Instill Confidence	✓			✓	✓	✓	✓	✓	✓

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KEY INITIATIVES & SUPPORTING ACTIONS			OBJECTIVES	KEY PERFORMANCE INDICATORS	Aligned UN SDGs	Aligned Roadmap Priority Themes	TIMING			KEY BENEFITS						
							Short Term	Mid Term	Long Term	Regulator Confidence	User Confidence	ESD / Climate	Economic Value	Social Licence	Market Growth	
7	Drive beneficiation and increased value of biochar products and co-products															
7.1	Fund research into beneficial upgrading of biochar products.	Increase biochar value by identifying specialty biochar products and uses.	1. Number of new biochar related products entering the market. 2. Number of biochar related patents being registered by Australian companies, organisations and individuals.	<div>8 DECENT WORK AND ECONOMIC GROWTH</div> <div>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</div> <div>11 SUSTAINABLE CITIES AND COMMUNITIES</div> <div>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</div> <div>13 CLIMATE ACTION</div>	Encourage Recognition & Policy Support											
					Facilitate Industry Scale Up	✓	✓	✓	✓	✓		✓		✓		✓
7.2	Research and evaluate substitution of biochar in traditional carbon markets.	Facilitate the establishment of biochar as a replacement material for fossil fuel derived carbon.	1. Uptake of biochar in traditional fossil fuel carbon markets.		Actively Seek Funding & Resourcing	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
7.3	Drive technical and economic outcomes of co-products from biochar production (e.g. energy, hydrogen and wood vinegar).	Optimise the economic and environmental benefits of biochar production in Australia through development and commercialisation of co-technologies and products.	1. Number of new biochar related co-products entering the market. 2. Number of biochar co-product patents being registered by Australian companies, organisations and individuals.		Encourage Investment	✓										
					Instil Confidence	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
7.4	Establish sequestration and downstream emissions avoidance potential for biochar used in different applications and with different feedstocks	Maximise the carbon drawdown potential of biochar through establishing strong frameworks for understanding carbon sequestration potential of different applications.	1. Number of industry accepted papers and guidance materials on carbon sequestration potential for different applications and feedstocks.	Accelerate Markets	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	
8	Safeguard responsible use and production of biochar															
8.1	Fast track the implementation of the ANZBIG Code of Practice and the certification of biochar for particular uses.	Develop and implement the Code of Practice for the Safe and Sustainable Production and Use of Biochar in Australia.	1. Certified biochar production sites using the Code of Practice. 2. Certification of safe and sustainable biochar production linked to carbon credit eligibility. 3. Development of branded certified biochar in Australia 4. Recognition of the Code of Practice by regulatory authorities	<div>8 DECENT WORK AND ECONOMIC GROWTH</div> <div>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</div> <div>11 SUSTAINABLE CITIES AND COMMUNITIES</div> <div>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</div> <div>13 CLIMATE ACTION</div>	Communicate Economic Value & Benefits											
					Facilitate Industry Scale Up	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8.2	Provide support for integration with other standards for sustainable sourcing and use of biomass.	Ensure that biomass is sustainably sourced by linking in with other programs and initiatives that already identify sustainability of biomass production.	1. Identification and verification of existing biomass certification schemes for applicability to biochar production and use. 2. Support for biochar producers in sustainable feedstock procurement through provision of suitable information.		Encourage Investment	✓	✓	✓	✓	✓				✓		
8.3	Develop guidance for rate-based application of biochar in soil applications including supporting research and demonstration.	Ensure consumers receive maximum benefit from biochar in soil applications.	1. Development of guidance material for biochar application rates for different soil and use applications.		Instil Confidence	✓										
					Harmonise Regulatory Frameworks	✓	✓	✓								
8.4	Develop a long term self funding mechanism for safeguarding the biochar sector such as through a certification levy.	Safeguard the economic future of the Australian Biochar Industry to ensure sustained future industry collaboration and growth.	1. Undertake annual progress reviews of long-term funding needs and strategies to self sustain the support and growth of the biochar industry.	Accelerate Markets		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
9	Support government, utility and industry procurement practices															
9.1	Identify and promote replacement or alternative procurement opportunities for biochar.	Ensure that biochar is considered for suitable public and industrial applications and as a substitute or replacement for fossil fuel derived carbon.	1. Number of alternate uses and new applications for biochar. 2. Total biochar use in different industry and government applications. 3. Number of policy initiatives implemented by governments to support industry scale up such as incentives, grants and levies.	<div>8 DECENT WORK AND ECONOMIC GROWTH</div> <div>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</div> <div>11 SUSTAINABLE CITIES AND COMMUNITIES</div> <div>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</div> <div>13 CLIMATE ACTION</div> <div>17 PARTNERSHIPS FOR THE GOALS</div>	Communicate Economic Value & Benefits											
					Facilitate Industry Scale Up	✓	✓	✓	✓	✓		✓		✓		✓
9.2	Establish biochar specifications for key procurement and use opportunities and identify carbon sequestration potential of these applications.	Ensure that suitable biochar is used for specific applications in government and industry.	1. Development of biochar specifications and guidelines for use for different public and industrial uses.		Encourage Investment	✓	✓			✓	✓	✓	✓	✓	✓	✓
					Instil Confidence											
9.3	Develop procurement and carbon sequestration biochar case studies and a biochar reference library for government and industry.	Ensure that government agencies and industry are aware of how best to use biochar in a range of applications.	1. Biochar case studies generated per year. 2. Use of case studies and library visits measured by downloads and site visits.		Accelerate Markets		✓		✓	✓	✓	✓	✓	✓		

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KEY INITIATIVES & SUPPORTING ACTIONS		OBJECTIVES	KEY PERFORMANCE INDICATORS	Aligned UN SDGs	Aligned Roadmap Priority Themes	TIMING			KEY BENEFITS					
						Short Term	Mid Term	Long Term	Regulator Confidence	User Confidence	ESD / Climate	Economic Value	Social Licence	Market Growth
10 Drive export of Australian biochar innovation internationally														
10.1	Link with Australian federal and state trade export and overseas collaboration initiatives	Ensure the Australian Biochar Industry has a strong international network and is well placed for international trade opportunities.	1. Interaction with Australian and overseas trade initiatives and establishment of collaborative initiatives 2. Successful export of Australian biochar technology and know how.	8 DECENT WORK AND ECONOMIC GROWTH 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 11 SUSTAINABLE CITIES AND COMMUNITIES 12 RESPONSIBLE CONSUMPTION AND PRODUCTION 13 CLIMATE ACTION 15 LIFE ON LAND 16 PEACE, JUSTICE AND STRONG INSTITUTIONS 17 PARTNERSHIPS FOR THE GOALS	Communicate Economic Value & Benefits									
						✓			✓	✓		✓		✓
10.2	Link with other global biochar initiatives such as IBI, EBIC, USBI and BNZ to exchange and influence.	Bring a coordinated and streamlined approach to the development of the global biochar industry that reflects the Australian perspective.	1. Attendance and presentations at global biochar forums and gatherings. 2. Strong participation as a member of IBI, an affiliate of EBIC and a supporter of BNZ.		Facilitate Industry Scale Up									
						✓	✓	✓		✓	✓	✓	✓	✓
10.3	Identify biochar production and use as part of Australia's global climate change contribution.	Ensure that the actions and activities that are contributing to carbon drawdown in Australia and through Australian activities elsewhere are articulated both domestically and internationally to key stakeholders.	1. Number of international climate change forums where the Australian biochar industry is prominent 2. Number of publications, papers, presentations and website hits related to Australian biochar activities.		Harmonise Regulatory Frameworks									
						✓	✓	✓		✓	✓	✓	✓	✓
					Accelerate Markets									
						✓	✓	✓		✓	✓	✓	✓	✓

Notes:
Indicative Resourcing is expected to come from both private industry and government.
UN SDG's = United Nations Sustainable Development Goals
¹Intergovernmental Panel on Climate Change (IPCC), 2019, *Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Volume 4: Agriculture, Forestry and Other Land Use, Appendix 4: Method for Estimating the Change in Mineral Soil Organic Carbon Stocks from Biochar Amendments