Australian Biochar Industry

2030 ROADMAP

ANZ BIOCHAR INDUSTRY GROUP
Contents

Foreword 3
Acknowledgments 4
Sponsors 5
Executive Summary 6
An Introduction to the Roadmap 7
Biochar soil applications and markets 9
UN Sustainable Development Goals 11
Roadmap Priority Themes 12

Initiative 1. Launch the Australian Biochar Industry 2030 Roadmap and fund industry scale up 13
Initiative 2. Improve stakeholder awareness and education of biochar uses and benefits 14
Initiative 3. Integrate and optimise industry and regulatory frameworks 16

Initiative 4. Support biochar commercial demonstrations and trials 17
Initiative 5. Leverage carbon emission reduction and CO₂ removal opportunities 18
Initiative 6. Encourage beneficial use of residual or waste biomass 19
Initiative 7. Drive beneficiation and increased value of biochar products and co-products 20
Initiative 8. Safeguard responsible use and production of biochar 21
Initiative 9. Support government utility and industry procurement practices 22
Initiative 10. Drive export of Australian biochar innovation internationally 23

Concluding Remarks 24

Appendix A - Other non-soil uses for biochar and bio-carbons 25
Appendix B - Key Initiatives and Supportive Actions Summary Table 27

Notification

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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
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 Samantha 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
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

Silver

Bronze

[Logos of sponsors]
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
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 pyroliqueous 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 CO₂ globally per year by 2050. This is indicatively equivalent to the USA’s annual GHG emissions (1990-2019).

(1) IPCC 6th Assessment Report, March 2022;
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.
**Biochar soil applications and markets**

*Figure 1. Biochar Soil Applications and Markets (Australia/NZ)*


Biochars are tailored to be fit for purpose.

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

**“Chars Ain’t Chars”**

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 CO$_2$ 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 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

- Communicate economic value and benefits
- Collaborate and Enhance Partnerships
- Encourage Recognition and Policy Support
- Facilitate industry scale up
- Accelarate Markets (including Commercial Demonstrations)
- Focus Innovation and Research
- Harmonise Regulatory Frameworks
- Establish Standards and Certification for industry production and usage.
- Encourage Investment
- Funding and Resourcing Support
- Priority 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
**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
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 biochar 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
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 landfulling 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 6

Aligns with Priority Themes
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.

### Initiative 7

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

**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

Aligns with Priority Themes
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
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)

“The permenance of CDR in non-soil applications is variable across the wide range of uses. This can be tested and assessed on a case by case basis.”

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).

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

Expanded upon on an original concept by Ithaka Institute 2016

**APPENDIX A**

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 original concept by Ithaka Institute (Draper, K, The Biochar Displacement Strategy, The Biochar Journal, 2016)

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

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**“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).
## 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

<table>
<thead>
<tr>
<th>KEY INITIATIVES &amp; SUPPORTING ACTIONS</th>
<th>OBJECTIVES</th>
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<th>UN SDGs</th>
<th>Aligned Roadmap</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Launch the Australian Biochar Industry 2030 Roadmap and Task Industry</td>
<td>Coordinate and convene development of the Australian biochar industry.</td>
<td>1. Roadmap launched.</td>
<td>8</td>
<td>18</td>
<td>Growth</td>
<td>Capacity Building and Funding</td>
</tr>
<tr>
<td>1.2. Engage with roadblocks on sustainability and governance</td>
<td>Ensure sufficient resources and systems are in place to successfully deliver the Australian Biochar Industry Roadmap.</td>
<td>1. Roadway adequately boosted. Proportion of Roadmap funding agents targets achieved (% of targets).</td>
<td>8</td>
<td>18</td>
<td>Growth</td>
<td>Capacity Building and Funding</td>
</tr>
<tr>
<td>1.3. Identify comprehensive funding opportunities and sources to support scale up.</td>
<td></td>
<td>1. Amount of complementary funding.</td>
<td>12</td>
<td>13</td>
<td>Funding and Incentives</td>
<td></td>
</tr>
<tr>
<td>1.4. Monitor and evaluate the scale and growth of the biochar sector.</td>
<td></td>
<td>1. Deliver Annual report on the state of the biochar industry sector in Australia.</td>
<td>17</td>
<td>17</td>
<td>Knowledge Development</td>
<td></td>
</tr>
<tr>
<td>2. Improve stakeholder awareness and education of biochar uses and benefits</td>
<td>Improve stakeholder awareness of biochar and co-product value proposition.</td>
<td>1. Integration of additional stakeholders. 2. Engagement and communications materials developed/leveraged.</td>
<td>12</td>
<td>12</td>
<td>Knowledge Development</td>
<td></td>
</tr>
<tr>
<td>2.2. Improve data sets and enable on biochar and co-product applications.</td>
<td>Enable greater access to credible and relevant resources on the Australian Biochar Industry and the uses of biochar and co-products. Collaborate with national and international associations to promote and disseminate knowledge sharing opportunities and platforms.</td>
<td>1. Development of facilitators, videos, and resources for engaging the Australian Biochar Industry. 2. Identification of missing resources, standards/guidelines that can be leveraged or adapted to assist and engage with stakeholders.</td>
<td>12</td>
<td>12</td>
<td>Knowledge Development</td>
<td></td>
</tr>
<tr>
<td>2.3. Engage with stakeholders regarding biochar and co-product value proposition, including development of technical working groups by industry sector and engagement and awareness.</td>
<td>1. Awareness of the ANZBIG Code of Practice and other standards in communication with stakeholders. 2. Training workshops on Biochar standards and the Code of Practice.</td>
<td>1. Breadth, number and regional extent of stakeholder forums, workshops and events. 2. Media content and stakeholder engagement via website, email and other forms of communication.</td>
<td>12</td>
<td>12</td>
<td>Knowledge Development</td>
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</tr>
<tr>
<td>2.4. Improve awareness of ANZBIG Code of Practice for the Sustainable and Safe Production and Use of Biochar and Approved Standards.</td>
<td>Ensure awareness of relevant biochar standards for the safe and sustainable production and use of biochar.</td>
<td>1. Interpretation of the ANZBIG Code of Practice and other standards to communicate with stakeholders. 2. Training workshops on “R eadership” standards and the Code of Practice.</td>
<td>12</td>
<td>12</td>
<td>Knowledge Development</td>
<td></td>
</tr>
<tr>
<td>2.5. Improve toolkit to demonstrate/measure and promote the co-benefits of biochar (including e.g. value addition for rice).</td>
<td>Increase the use of biochar products and technology by facilitating stakeholders to efficiently and correctly apply biochar products.</td>
<td>1. Awareness for the application and use of biochar for different uses including horticulture, rice field, biodiesel, agriculture and industrial applications. 2. Published cost benefit analyses of biochar applications.</td>
<td>12</td>
<td>12</td>
<td>Knowledge Development</td>
<td></td>
</tr>
<tr>
<td>2.6. Integrate indigenous land knowledge and practices (e.g. fire management) into biochar educational and awareness materials.</td>
<td>Acknowledge and support Indigenous knowledge and land practices that relate to biochar use and applications.</td>
<td>1. Research and documented Indigenous land practices related to biochar application and use. 2. Works with Indigenous groups to exchange knowledge and land practices around biochar use. 3. Support Indigenous participation in the biochar industry.</td>
<td>12</td>
<td>12</td>
<td>Knowledge Development</td>
<td></td>
</tr>
<tr>
<td>2.7. Research and industry community initiatives for biochar.</td>
<td>Understand the success or otherwise of Roadmap initiatives and actions</td>
<td></td>
<td>17</td>
<td>17</td>
<td>Knowledge Development</td>
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</tbody>
</table>

### APPENDIX B

**www.anzbig.org**
<table>
<thead>
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<td>4.4 Support biochar commercial demonstrations and trials</td>
<td>1. Support assessment and ranking of biochar demonstration projects.</td>
<td>1. Outline criteria and seek expressions of interest for potential demonstration partners. 2. Establish establishment of demonstration projects.</td>
<td>2. Technology Development</td>
<td>2. Commercial Demonstrations</td>
<td>Short Term</td>
<td>Economic, Social, Public Confidence</td>
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<td>4.5 Establish biochar demonstration projects for non-soil uses</td>
<td>1. Support development of a biochar method for feed chars to reduce methane from livestock.</td>
<td>1. Support of existing efforts to include biochar in the Integrated Assessment Modelling. 2. Support demonstration for broadacre soil applications at a significant scale. Increase economic confidence in large-scale applications of biochar within Australia.</td>
<td>5. Technology Development</td>
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<td>4.6 Further incentivise circular production of residual biomass to biochar.</td>
<td>1. Use biochar to accelerate climate action on critical livestock methane sources.</td>
<td>1. Support research initiatives to characterise the effect of feed chars on methane reduction. 2. Support of existing efforts to include biochar in the Integrated Assessment Modelling.</td>
<td>6. Economic Growth</td>
<td>6. Circular Production</td>
<td>Mid Term</td>
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<td>4.7 Support biochar inclusion into the Integrated Assessment Modelling.</td>
<td>1. Support biochar inclusion into the Integrated Assessment Modelling.</td>
<td>1. Support the adoption of biochar as a pillar technology in the Australian biochar production industry as a Net Zero technology. 2. Support of existing efforts to include biochar in the Integrated Assessment Modelling.</td>
<td>7. Affordable and Clean Energy</td>
<td>7. Integrated Assessment Modelling</td>
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<td>7 Drive beneficiation and increased value of biochar products and co-products</td>
<td>Increase biochar value by identifying specialty biochar products and uses.</td>
<td>1. Number of new biochar-related products entering the market. 2. Number of biochar-related patents being registered by Australian companies, organizations and individuals.</td>
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<td>7.1 Fund research into valorising and upgrading biochar products.</td>
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<td>8 Decent work and Decent work and</td>
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<td>7.2 Research and evaluate substitution of biochar in traditional carbon markets.</td>
<td>Facilitate the establishment of biochar as a replacement material for fossil fuel-derived carbon.</td>
<td>1. Uptake of biochar in traditional fossil fuel carbon markets.</td>
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<tr>
<td>7.3 Drive technical and economic outcomes of co-products from biochar production (e.g., energy, hydrogen and waste energy).</td>
<td>Optimize the economic and environmental benefits of biochar production in Australia through development and commercialization of co-products and products.</td>
<td>1. Number of new biochar-related co-products entering the market. 2. Number of biochar-related co-products being registered by Australian companies, organizations and individuals.</td>
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<td>7.4 Establish sequestration and downstream emissions avoidance potential for biochar used in different applications and with different feedstocks.</td>
<td>Maximize the carbon sequestration potential of biochar through establishing strong frameworks for understanding carbon sequestration potential of different applications.</td>
<td>1. Number of industry accepted papers and guidance material on carbon sequestration potential for different applications and feedstocks.</td>
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<td>8 Safeguard responsible use and production of biochar</td>
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<td>8 Decent work and Decent work and</td>
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<tr>
<td>8.1 Fast track the implementation of the ANZBIG Code of Practice and the certification of biochar for particular uses.</td>
<td>Develop and implement the Code of Practice for the Safe and Sustainable Production and Use of Biochar in Australia.</td>
<td>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.</td>
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<tr>
<td>8.2 Provide support for integration with other standards for sustainable sourcing and use of biomass.</td>
<td>Ensure that biomass is sustainably sourced by linking in with other programs and initiatives that already identify sustainability of biomass production.</td>
<td>1. Identification and verification of meeting biomass certification scheme for eligibility to biochar production and use. 2. Support for biochar producers in sustainable feedstock procurement through provision of suitable information and support. 3. Number of biochar-related patents being registered by Australian companies, organizations and individuals.</td>
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<tr>
<td>8.3 Establish guidelines for risk-based application of biochar in soil applications including supporting research and demonstration.</td>
<td>Ensure consumers receive maximum benefit from biochar in soil applications.</td>
<td>1. Development of guidance material for biochar application rates for different soil and use applications.</td>
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<tr>
<td>8.4 Develop a long-term funding mechanism for safeguarding the biochar sector such as through a certification levy.</td>
<td>Safeguard the economic future of the Australian Biochar Industry to ensure sustained future industry collaboration and growth.</td>
<td>1. Undertake annual progress reviews of long-term funding needs and strategies to self-sustain the support and growth of the biochar industry.</td>
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<tr>
<td>9 Support government, utility and industry procurement practices</td>
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<td>11 Sustainable Cities</td>
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<tr>
<td>9.1 Identify and promote replacement or alternative procurement opportunities for biochar.</td>
<td>Ensure that biochar is considered for suitable public and industrial applications and as a substitute or replacement for fossil fuel-derived carbon.</td>
<td>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 loans.</td>
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<tr>
<td>9.2 Establish biochar specifications for key procurement and use opportunities and identify carbon sequestration potential of these applications.</td>
<td>Ensure that suitable biochar is used for specific applications in government and industry.</td>
<td>1. Development of biochar specifications and guidelines for use for different public and industrial uses.</td>
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<tr>
<td>9.3 Develop procurement and carbon sequestration biochar case studies and a biochar reference library for government and industry.</td>
<td>Ensure that government agencies and industry are aware of how best to use biochar in a range of applications.</td>
<td>1. Biochar case studies generated per year. 2. Use of case studies and library visits measured by downloads and site visits.</td>
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<tr>
<td>10 Drive export of Australian biochar innovation internationally</td>
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<tr>
<td>10.1 Link with Australian federal and state trade export and overseas collaboration initiatives</td>
<td>Ensure the Australian Biochar industry has a strong international network and is well placed for international trade opportunities.</td>
<td>1. Interaction with Australian and overseas trade initiatives and establishment of collaborative initiatives 2. Successful export of Australian biochar technology and know how.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>10.2 Link with other global biochar initiatives such as IBI, EBIC, USBI and BNZ to exchange and influence.</td>
<td>Bring a coordinated and integrated approach to the development of the global biochar industry that reflects the Australian perspective.</td>
<td>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.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
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<td>10.3 Identify biochar production and use as part of Australia’s global climate change contribution.</td>
<td>Ensure that the actions and activities that are contributing to the reduction of greenhouse gases in Australia and through Australian activities elsewhere are articulated both domestically and internationally to key stakeholders.</td>
<td>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.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Notes:**
- Indicative Resourcing is expected to come from both private industry and government.
- UN SDGs = United Nations Sustainable Development Goals.
- "Indicators are not intended to cover all aspects of the outcomes of the implementation of this strategy. They are merely illustrative indicators that are likely to be measured and reported on within the Australian Biochar Industry Strategy (ABIS) framework."
- "References include: 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."