

# SUBMISSION

*Accelerating SA's transition  
to a circular economy*

**South Australia's Waste  
Strategy 2025-2030**

July 2025



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### APPENDICES:

- **Appendix 1: South Australian Parliamentary Inquiry into Biochar**
- **Appendix 2: Australian Biochar Industry 2030 Roadmap (V2 Aug 2024)** – including
  - alignment with national policies
- **Appendix 3: ANZBIG Decoupling Policy Paper** - Modernising Resource Recovery and Energy Policies: Decoupling Biochar Bioenergy Systems from Linear Energy from Waste Systems for Circular and Regenerative Benefits.
- **Appendix 4: Modified Resource and Energy Recovery Hierarchy (A3)**
- **Appendix 5: Water Industry (WSAA) Submission to CEMAG – ‘Help Us Help You’ (2023)** – *Opportunities Technical Papers – Opportunity 1: Biochar*

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# Industry Submission:

## Accelerating SA’s transition to a circular economy

### South Australia’s Waste Strategy 2025-2030

July 2025

### Introduction

The Australia New Zealand Biochar Industry Group (ANZBIG) is the national peak body representing the biochar industry. We have a highly experienced executive board of 10, an advisory board of 6, with 40 working group members, and a broad membership of over 200 members with all levels of the value chain represented. Many members have multi-million dollar technology or projects globally.

Our working groups are aligned with our *Biochar Industry 2030 Roadmap* ([ANZBIG 2030 Roadmap](#)) that aims to build an industry with the potential to pyrolyse 50 million tonnes of biomass waste per annum to mitigate 10-15% of Australia’s greenhouse gas (GHG) emissions by making 15 million tonnes of biochar worth \$5-7.5 billion per annum, while producing 300 million GJ of energy worth \$5 billion. The potential of the Australian biochar industry is worth at least \$13 billion per annum, and could provide up to 20,000 permanent jobs including in rural and regional areas, as illustrated in the figure below.

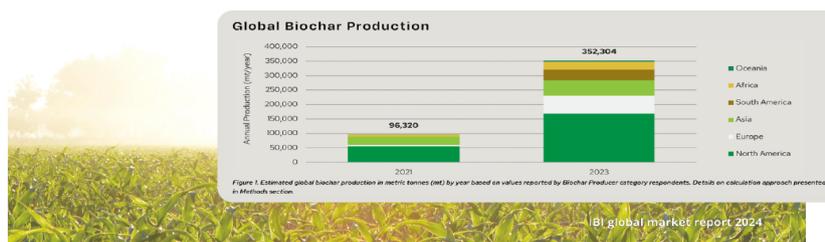
### Multi Billion Dollar Industry by 2030

Indicative potential for converting Australia’s >50 Million tpa of biowastes into biochar to assist Australian agriculture:

- \$5-\$7.5 Billion pa – Biochar value (physical commodity)
- \$3.5 Billion pa – Biochar carbon dioxide removal (CDR) value
- \$2 Billion pa – Agricultural productivity gains
- \$16.5 Million pa - Renewable energy savings
- \$90 Million pa - Soil carbon growth value
- (plus 12-50% reduction in other GHG’s (N2O etc) released from ag soils)
- \$32 Million pa - Water savings (through 0.5% increase in soil carbon in 10% of Ag land)

*The theoretical sequestration potential for biochar and bioenergy in Australia is estimated to be 30–60 Mt carbon dioxide equivalents (CO<sub>2</sub>-e) per year (CSIRO, 2022)*

**Total Value \$13 billion dollars annually**



Biochar is being used or proposed in a range of key sectors, including to:

- achieve the Australian Government’s **Agricultural Productivity Target**, whilst recycling carbon and improving soil natural capital;
- **decarbonise hard to abate industrial sectors and the built environment, including roads, concrete, steel and more;**
- **support restoration of degraded and marginal lands, including mine site rehabilitation;**
- **Treat and safely deconstruct emerging contaminants such as PFAS and microplastics** which can be present in a range of organic wastes and are increasingly constraining options for beneficial reuse (e.g. biosolids, FOGO, compost).

To deliver the Roadmap’s objectives, we need policy support and funding, which was included in a range of supportive recommended actions from the SA Parliamentary Inquiry into Biochar (refer Appendix 1a,1b,1c). ANZBIG has already implemented some of the suggested actions such as developing a draft Australian carbon credit unit (ACCU) methodology for biochar, and have aligned with Standards Australia to produce an Australian Standard for Biochar use which is currently under development.

Thank you for the opportunity to provide this submission on behalf of ANZBIG to Green Industries SA (GISA) on its draft strategy *Accelerating SA’s transition to a circular economy: South Australia’s waste strategy 2025–2030* (Draft Strategy). We appreciate that the Draft Strategy builds upon *Supporting the circular economy: South Australia’s waste strategy 2020-2025* and is intended to establish “a framework of strategic objectives, targets and priority actions that will accelerate SA’s transition to a circular economy and help meet our priorities for a sustainable economy and net zero emissions by 2050”.

**This submission is intended to show how the Australian biochar industry stands uniquely poised to assist the South Australian Government in delivering against multiple public policy objectives, specifically these objectives outlined in the Draft Strategy (p.6):**

*“Globally we have gone beyond planetary boundaries, causing environmental impacts such as climate change and biodiversity loss. If Australia is to meet our commitments under the United Nations’ 2030 Agenda for Sustainable Development, we need to accelerate our transition to a more circular economy to achieve the system-wide transformation that’s required. This transition is essential to reducing our reliance on virgin resources, eliminating waste and pollution, tackling biodiversity loss, and achieving net zero emissions while supporting the needs of current and future generations of South Australians.”*

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. Through the use of these technologies, we can capture, utilise and store carbon (CCUS) for the long term (centuries to millennia), reduce waste, produce clean and renewable bioenergy, and remove CO<sub>2</sub> from the atmosphere.

Pyrolysis of organic wastes produces valuable renewable liquids and combustible gas (syngas) and thermal energy, with the principal components of the gas being CO and hydrogen (and CH<sub>4</sub> at lower temperatures). Gasification yields a combustible syngas (a fuel gas) and heat as the key outputs, with smaller amounts of char, with the principal components of its gas also being CO and hydrogen (H<sub>2</sub>).

Up to half the carbon in the feedstock is retained in the solid biochar produced via pyrolysis, and additional carbon recovered in liquid products. This is a significant point of difference between full combustion and pyrolysis. Biochar production is one of the key Carbon Dioxide Removal (CDR) methods recognised by the UN Intergovernmental Panel on Climate Change (IPCC), and one of the most cost-effective CDR methods available.

**Importantly, biochar bioenergy systems have the potential to concurrently provide both clean renewable energy to displace fossil fuels (Emissions Reduction, ER) and sequester existing CO<sub>2</sub> from the atmosphere into soil (and non-soil) applications that are durable in the long term (CDR).**

Clean syngas can also provide the chemical ‘building blocks’ for making other valuable materials and products (syngas ‘derivatives’), such as renewable/low carbon fuels (including sustainable aviation fuel, SAF), methanol and olefins for circular bioplastics, among others.

**Materials that would otherwise represent wastes and that can be difficult or expensive to manage appropriately can become co-feedstocks / resources delivering a range of social, economic and environmental benefits and assist in moving towards a circular economy.**

We represent an industry that has seen its value rise to potential for generating an estimated \$13 billion by 2030 and delivering significant public and environmental benefit despite not receiving any significant Australian Government funding to date.

**In June 2021 ANZBIG launched the *Australian Biochar Industry 2030 Roadmap (ANZBIG 2023) (ANZBIG 2030 Roadmap)*, a world-first for the biochar industry. Roadmap initiatives and actions are aligned with the UN Sustainable Development Goals (SDGs) and multiple Government policy objectives, including those of the South Australian Government.**

This submission has been informed through ongoing engagement with the biochar industry and its community over a number of years, including during development of the *Australian Biochar Industry 2030 Roadmap*, and via other submissions to government listed in the additional available supporting information to our submission. ANZBIG welcomes the opportunity to meet with GISA further to discuss this response to the Draft Strategy and to address the significant opportunities that the biochar industry offers SA.

### **Key Points**

- **ANZBIG generally supports the Draft Strategy overall and most of its detailed actions, and we commend GISA’s efforts in developing integrated, practical and robust strategies to benefit South Australia. Notwithstanding this, despite the positive findings and recommendations of a recent SA Parliamentary Inquiry into Biochar, ANZBIG note the Draft Strategy still does not mention biochar at all.** Given the very significant potential for circular carbon benefits via biochar, ANZBIG calls for this unfortunate omission to be rectified as a priority action.
  - We raise this as the State of Queensland directly sought out and actively engaged with the ANZBIG Board and Members while seeking feedback for their recent waste strategy.
- Biochar bioenergy systems can facilitate the upcycling of organic wastes into valuable circular carbon resources in solid, liquid and gas forms, concurrently providing critical action on circularity, sustainability, regeneration of nature and climate goals, improving security and resilience for food, energy and water resources.
- **Biochar production and use provides *both* of the two critical actions required for climate change – Emissions Reduction (ER) by displacing fossil carbon in multiple ways, and CO<sub>2</sub> Removal (CDR) by carbonising photosynthetic waste biomass into a long term stable form of solid carbon (biochar), taking it out of the sky and bringing back down to earth where we need it most. Even more importantly, this can be done right throughout the supply chain of the economy, providing critical benefits for *Scope 3 emissions* in addition to Scopes 1 and 2.**
- ANZBIG advocates for the regulatory facilitation in SA of biochar production and use at all scales.
- ANZBIG’s *Australian Biochar Industry 2030 Roadmap (ANZBIG 2030 Roadmap)* (refer **Appendix 2**) details significant opportunities for economic development, eliminating waste and pollution, circulating products and materials at their highest value and regenerating nature based on core circular economy principles embedded throughout the Draft Strategy. Alignment of Roadmap initiatives and actions with the UN SDGs and multiple Government policy objectives are detailed throughout the Roadmap. **ANZBIG recommend supporting and funding rollout of the Roadmap to help the South Australian Government actively deliver against key objectives of the Draft**

**Strategy, including moving towards net zero and a circular economy, as detailed in this submission.**

- **Evaluation of ‘higher order use’ in recovery of resources by regulators should consider contributions toward addressing modern critical challenges such as climate change, food and water security and resilience, and sustainability, among other factors. ANZBIG encourages GISA to consider the enclosed *Decoupling Policy Paper* (refer Appendix 3) to help facilitate this.**
- ANZBIG has proposed a Resource and Energy Recovery Hierarchy (refer **Appendix 4**) within the *Decoupling Policy Paper* that integrates a range of key issues that GISA has considered in the Draft Strategy, including circulating materials at their highest value in ways that should help increase social license. **ANZBIG recommends that the Resource and Energy Recovery Hierarchy be considered and integrated by GISA in proposed strategies and actions as an alternative to the current consideration of energy from waste (EfW) and to the waste management hierarchy, which is over 40 years old by now.**
- The *Decoupling Policy Paper* provides technical and policy justifications for the separation of linear EfW systems (single use of resources for power/energy alone, e.g. incineration) from more circular and regenerative forms of EfW, such as biochar bioenergy technologies, as well as recognising the now critical associated climate and sustainability benefits of these higher order uses that are not reflected in the waste management hierarchy.
- **Waste levy funds should be directed to accelerating circular solutions to waste disposal, including emerging innovation. ANZBIG suggests a variety of means for doing so, including supporting key relevant areas of the *Australian Biochar Industry 2030 Roadmap*.**
- ANZBIG supports SA’s practice of enabling materials to no longer be considered ‘wastes’ when specific steps are taken. We also support Queensland’s application of End of Waste Codes to similar effect, including the recent release of an End of Waste Code specifically for biochar. **ANZBIG support the use of End of Waste approaches as a means of encouraging innovation and technical trials / pilots to develop more circular practices while regulatory policies and practices are reformed to enable more circular outcomes.**
- These recommendations are consistent with, and should be supported by, guiding principles for regulatory reform developed by several members of ANZBIG’s Policy & Regulatory Working Group:
  - Revise definitions relating to ‘waste’ in legislation.
  - Revise definitions relating to ‘thermal treatment’ in legislation to decouple linear ‘single-use’ EfW processes (e.g. combustion / incineration for end-of-life disposal) from circular and regenerative EfW processes (e.g. pyrolysis and gasification of biomass).
  - Take an *outcomes-based* focus on ensuring safe emissions and fit for purpose products.
  - Enable production and usage of biochar to be considered a ‘higher order use’ or ‘higher value use’.
  - Establish innovation pathways that facilitate and accelerate temporary pilot trials and commercial scale demonstrations of new innovations in biochar production and use (applications).
  - Facilitate circular economy and climate-positive outcomes and define when ‘wastes’ become *resources*.
  - Integrate with new financial disclosure and sustainability reporting frameworks (e.g. IFRS S1 and S2).
  - Reflect scale, type and risk of activities proportionally in policies and regulations.
  - Include consideration against ‘business as usual’ to enable improved outcomes.
  - Support collaborations amongst aligned industries that advocate for similar approaches.

- Realise that biomass waste can be turned into a *minimum* of three revenue streams being biochar, renewable energy and carbon dioxide removal (CDR).
- Incentivise biochar use, including a multi-faceted approach involving both direct and indirect support measures.

## South Australian Parliamentary Inquiry into Biochar

On 28 November 2023, following extensive investigation and consultation, the SA *Natural Resources Committee* tabled a comprehensive report with state parliament on its Inquiry into Biochar. Deputy Premier and Minister for Climate, Environment and Water, the Hon Susan Close MP, subsequently provided a formal government response to the range of supportive actions and recommendations made in the report. Many of these recommendations could be facilitated under the *Australian Biochar Industry 2030 Roadmap* if resources could be secured from the SA Government (and others) to implement the roadmap and grow the fledgling biochar industry.

**Responses by Deputy Premier Close and Mary-Anne Healy, Director for Department for Environment and Water are provided in Appendix 1a and Appendix 1b, respectively, for the following six recommendations by the SA Government Natural Resources Committee Parliamentary Inquiry into Biochar (Appendix 1c):**

- *Recommendation 1: The State Government proposes to the Federal Government the creation of product and production standards, including codes of practice, for biochar production and use.*
- *Recommendation 2: The State Government endorses to the Federal Government the development of a certification mechanism that biochar producers or suppliers can apply to.*
- *Recommendation 3: The State Government generate or facilitate support for large scale and longitudinal biochar trials.*
- *Recommendation 4: That the State Government facilitates a knowledge, attitude, and practice (KAP) survey among potential biochar consumers.*
- *Recommendation 5: That the State Government advocates for the inclusion of biochar in the Emissions Reduction Fund of the Clean Energy Regulator.*
- *Recommendation 6: That the State Government considers a review of the waste management hierarchy.*

**Recommendations 1, 2 and 5 were supported and actioned by Deputy Premier Close. Recommendations 3 and 6 were supported in principle and intent, respectively. For Recommendation 4, it was suggested that ANZBIG or another industry group would be a more appropriate facilitator than the State Government. (refer Appendix 1a)**

## About ANZBIG

The **Australia New Zealand Biochar Industry Group (ANZBIG)** is the peak body for the biochar industry. ANZBIG facilitates and assists companies, governments and institutions in the effective and sustainable production and use of biochar.

**Our vision:** Australia and New Zealand as global leaders in the sustainable production and use of biochar.

**Our mission:**

- The Australian and New Zealand Biochar Industry Group will facilitate and assist companies, governments and institutions in the effective use and production of biochar.
- ANZBIG will focus and streamline biochar education, research, collaboration and commercialisation activities to provide better outcomes for the societies of Australia and New Zealand.

*‘We believe that a Biochar Industry Cluster is an essential part of the next industrial revolution, creating a more sustainable future and positioning for greater economic prosperity, increased job opportunities and continued quality of life for all of us.’*

ANZBIG is patroned by renowned economist Professor Ross Garnaut, who provides a forward to the Australian Biochar Industry 2030 Roadmap.

ANZBIG has developed **strategic partnerships and alliances/MOUs** with allied industries, including (but not limited to) the following:

- **Water Services Association of Australia (WSAA)** – the peak body for the water industry
- **Australian Organics Recycling Association (AORA)** – peak body for organics and composting
- **Farmers for Climate Action**
- **NSW Decarbonisation Hub**
- **Newcastle Institute of Energy & Resources (NIER).**

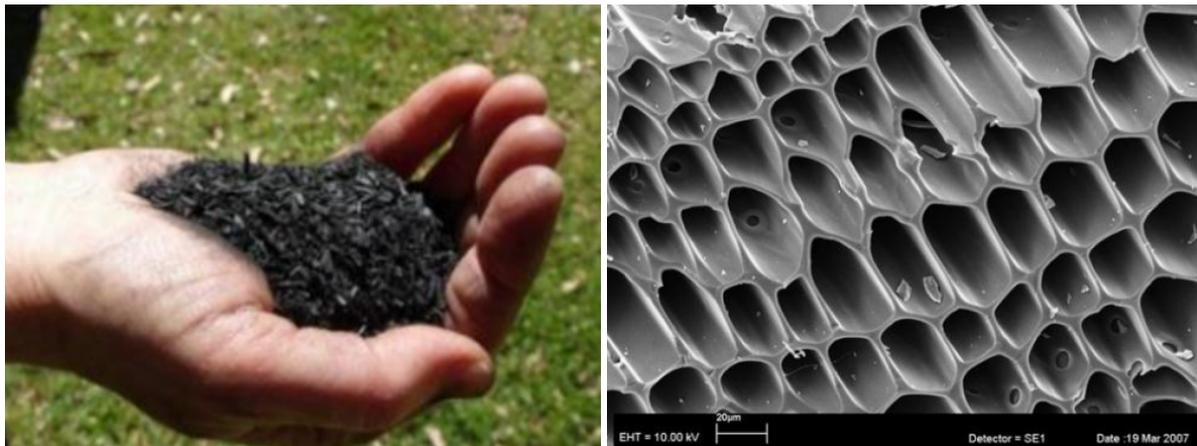
Emergence of the commercial biochar industry in Australia includes:

- Inauguration in the 2000s, R&D at national and state levels
- World’s longest running field trials located at Wollongbar NSW (NSW DPIRD)
- Biochar Researchers Network of ANZ (active until 2014)
- Formation of ANZ Biochar Initiative in 2017
- Evolution to an industry group in 2020 (ANZ Biochar Industry Group)
- Focused on: education & awareness, standards & certifications, supply & market development, policy & regulatory / advocacy, resourcing
- ~200 members including corporates, entrepreneurs, academics, capital, and governments at all levels
- Multiple Australian technologies (small mobile systems to large centralised plants)
- Members with multi-million dollar projects underway worldwide
- Established a national Code of Practice in 2021 (including biochar quality gradings), with a revised Code in progress (2025)
- Established the world’s first biochar industry roadmap (June 2023)
- Member of the cross-industry working group for a proposed ACCU method for Biochar CO<sub>2</sub> Removal (2024)
- Recently released Farmers Guide for sustainable production and use of biochar
- Successfully lobbied for updating of the national emissions inventory (NGERS framework) to address inclusion of biochar carbon dioxide removal (2025)
- Leading development of a dedicated Australian Standard for the grading of biochars and biocarbons for fit for purpose end uses.

## What is Biochar, how is it made and why is its production important?

**Biochar** is “a carbon rich, charcoal-like product made by heating any form of organic matter (biomass) in a controlled process with limited oxygen. 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” (ANZBIG 2023).<sup>1</sup>

Through the use of biochar technologies, we can capture, utilise and store carbon (CCUS) for the long term (centuries to millennia), reduce waste, produce clean and renewable bioenergy, and remove CO<sub>2</sub> from the atmosphere.



### How is Biochar made and what other Co-Products & Co-Benefits does it bring?

Heating materials progressively changes physical phase from solids to liquids to gases. Subsequently, modern commercial pyrolysis and gasification processes typically produce two or more products across these phases. Typically up to 1/3 of the biomass feedstock is converted to solid biochar *in pyrolysis*, with the remainder reporting to liquids and/or gas (‘syngas’) products and heat (thermal energy), as illustrated in **Figure 1**. Biochar’s chemical, physical and biochemical properties differ, reflecting the feedstock, processing conditions and any pre or post-treatments applied, and the quality and properties of the biochar dictates its most suitable and appropriate potential end uses/applications. **In 2021 ANZBIG established a voluntary industry Code of Practice for the sustainable production and use of biochar, based upon which a new Australian Standard for grading the quality of biochar and biocarbons has commenced and is currently in progress** (expected to be released for public comment early in 2026). The standard seeks to guide ‘fit-for-purpose’ quality of biochars which is expected to provide further regulatory and market confidence to significantly assist the industry to grow.

#### Biochar and significant renewable energy

Pyrolysis and gasification processes also create a potentially **valuable gas co-product called syngas** (‘synthetic gas’), typically comprised primarily of H<sub>2</sub> and CO, CH<sub>4</sub> (and minor gases). When produced in a pure process or via further refining (‘cleanup’), syngas can be either used directly for on-demand renewable energy/heat, for drying of feedstocks, or further processed into a range of syngas derivatives including green hydrogen and food and medical grade CO<sub>2</sub> (to displace fossil CO<sub>2</sub>), biomethane (renewable natural gas, rNG) and a range of high value *circular fuels*, as illustrated in **Figures 1,2**. This further displaces fossil carbon (via ‘gas to X’ pathways) for additional critical climate action. As such, **biochar bioenergy systems generating biochar and syngas can concurrently aid the**

<sup>1</sup> A Fact Sheet is available [here](#) and link to a brief introductory video “What is Biochar?” provided [here](#).

**two critical elements required for climate action toward Net Zero: emissions reduction (ER) and carbon dioxide removal (CDR).**

### *Biochar applications*

**Sustainable biochar production is a powerful tool that is being recognised globally for its potential to produce clean renewable energy, sequester CO<sub>2</sub> from the atmosphere, improve soil health, and support sustainable agriculture. Figure 3 also shows biochar’s alignment with the UN SDGs.** The circular carbon and climate benefits of biochar can be used to displace fossil carbon currently used in a wide range of industries across the economy, with scores of fully commercialised soil and non-soil/industrial applications already available here and overseas, from animal feeds to soil ameliorants that minimise synthetic fertilizer use through to water filtration, roads, bioplastics and concrete among many others (refer **Figures 4,5**). These are outlined in the *Australian Biochar Industry 2030 Roadmap*.

### *Biochar and sustainable land use*

The biochar industry is poised to play a vital role in sustainable land use and the circular economy. The *Australian Biochar Industry 2030 Roadmap* outlines the steps needed to scale the biochar industry to a multibillion-dollar sector, highlighting the significant potential to displace fossil carbon used in a wide range of materials and uses across the entire economy in both soil and non-soil/industrial applications, and make potentially significant contributions toward national and state decarbonisation and circular economy goals.

### *Further significance of investing in biochar*

**The above has been further recognised by the Commonwealth’s Circular Economy Ministerial Advisory Group (CEMAG) in its final report to then-Minister Plibersek in December 2024, which recommended action to “reduce barriers for markets for biochar and other organic materials”.**

As an important indicator of global leadership in this direction, the government of Denmark reportedly has allocated the equivalent of **2.2 billion AUD specifically to accelerating the biochar industry in Denmark** and has released its [biochar strategy](#), similar to the existing *Australian Biochar Industry 2030 Roadmap*, which notably has not received any external funding at all yet, and is seeking a fraction of that provided in Denmark. The Danish strategy forms part of its goal to save 1.8Mt CO<sub>2e</sub> in agricultural emissions by 2030. Supportive policies for biochar have also been adopted within: the EU’s recent Trilogue on Carbon Removal Certification Framework (CRCF); the USDA’s Soil Carbon Amendment Code and associated financial assistance program; and the Swiss ‘CDR Roadmap’ for CCS and Negative Emissions Technologies (NETs).

## **What are Biocarbons and other similar chars?**

Biocarbons and other similar chars are also made from plant-based biomass (from plants in the current natural carbon cycle), however differ from ‘biochar’ via their end use **not** providing durable storage of the carbon in the long term (i.e. no long term sequestration >100 years). In these cases the carbon that had been captured by the plant material during its life and *temporarily* converted into solid char is **re-released back into the atmosphere**. As such, biocarbons and related chars are typically used for **combustive or oxidative purposes** such as **fuels and reductants**. These are illustrated in **Figure 6**.

## Towards a Circular Economy and Net Zero through Carbon Stewardship

Figure 7 shows how we see these factors supplementing the traditional model for circular economy, the Butterfly Diagram, developed by the Ellen MacArthur Foundation.

Figure 1 (below): **Biochar intercepts the carbon cycle to remove CO<sub>2</sub> (CDR).** Biochar is one of the handful of Negative Emissions Technologies recognised by the IPCC for CDR.

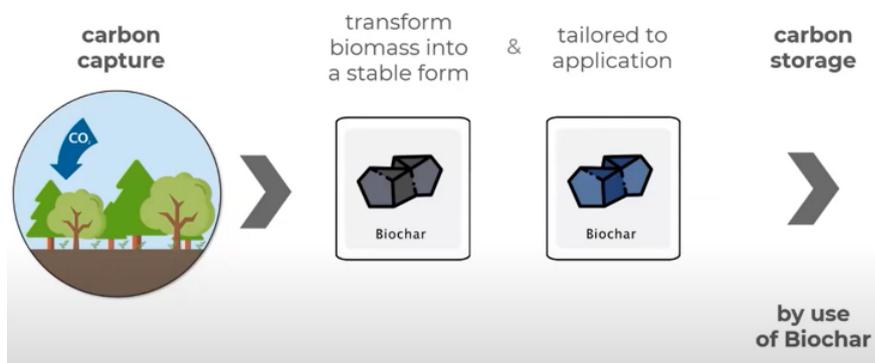
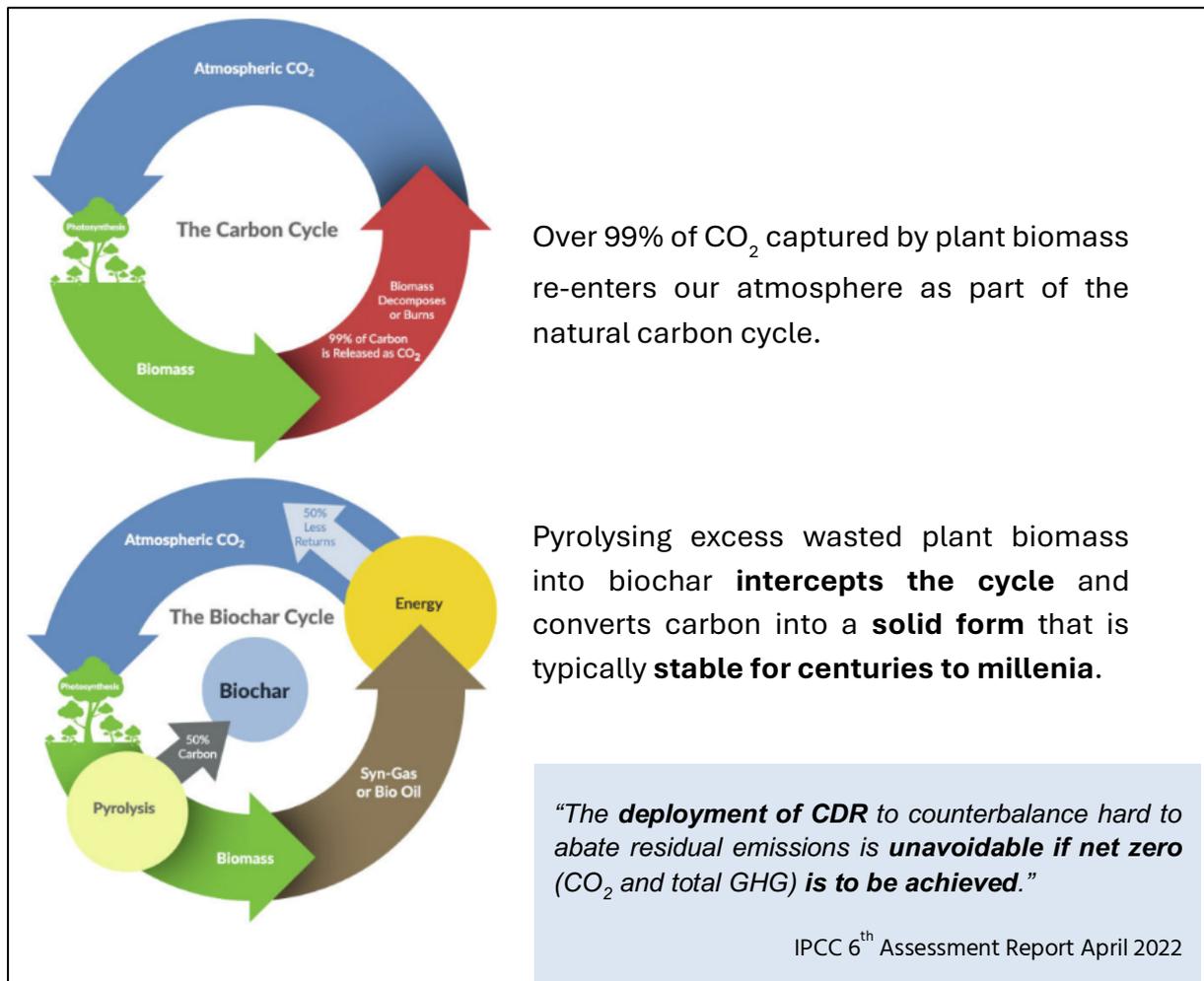


Figure 2 (above): Biochar CO<sub>2</sub> Removal (B-CDR, or BCR)

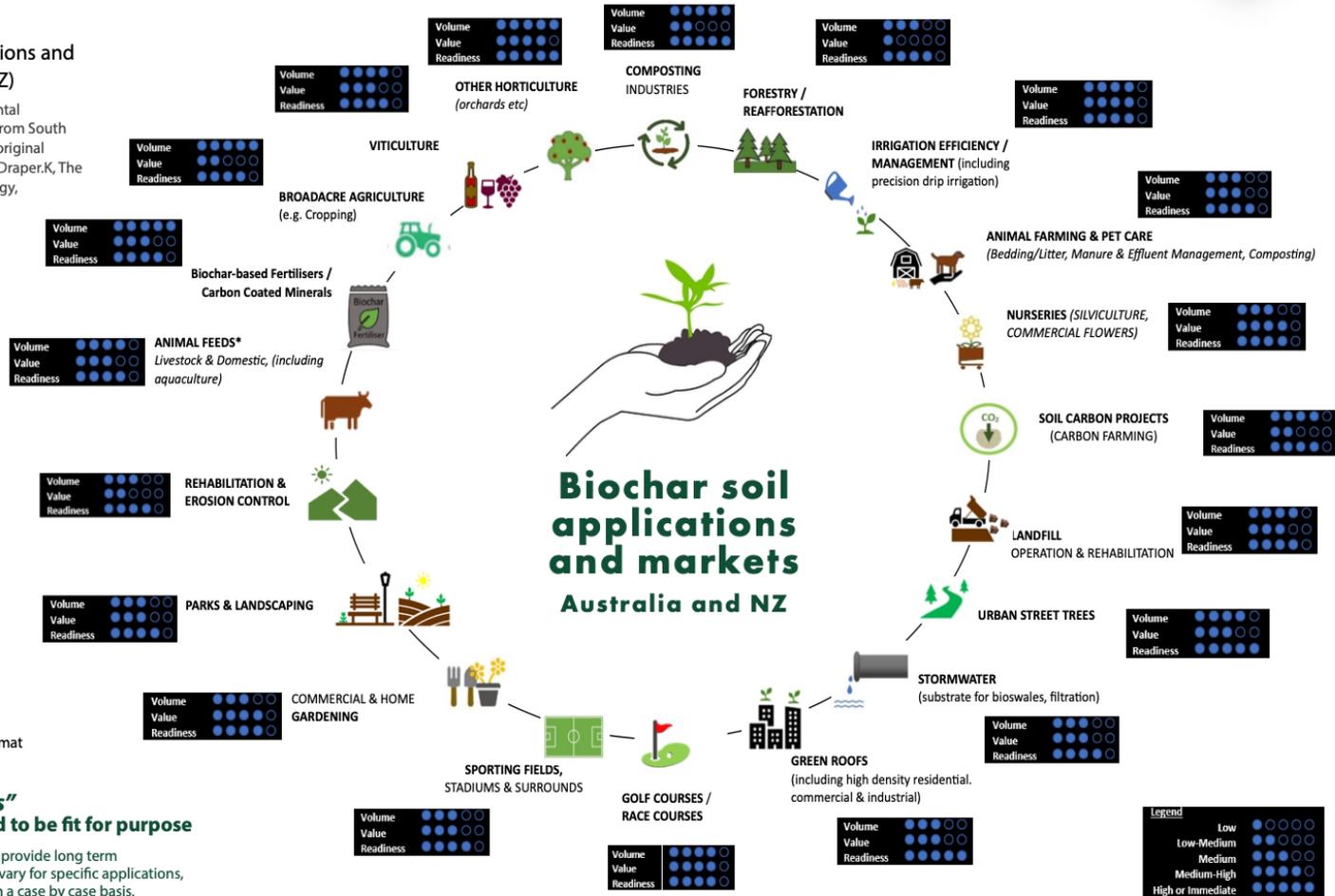
Capturing carbon, valuably using and storing it in the long term.



Figure 3: UN Sustainable Development Goals (SDGs) aligned with biochar

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

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

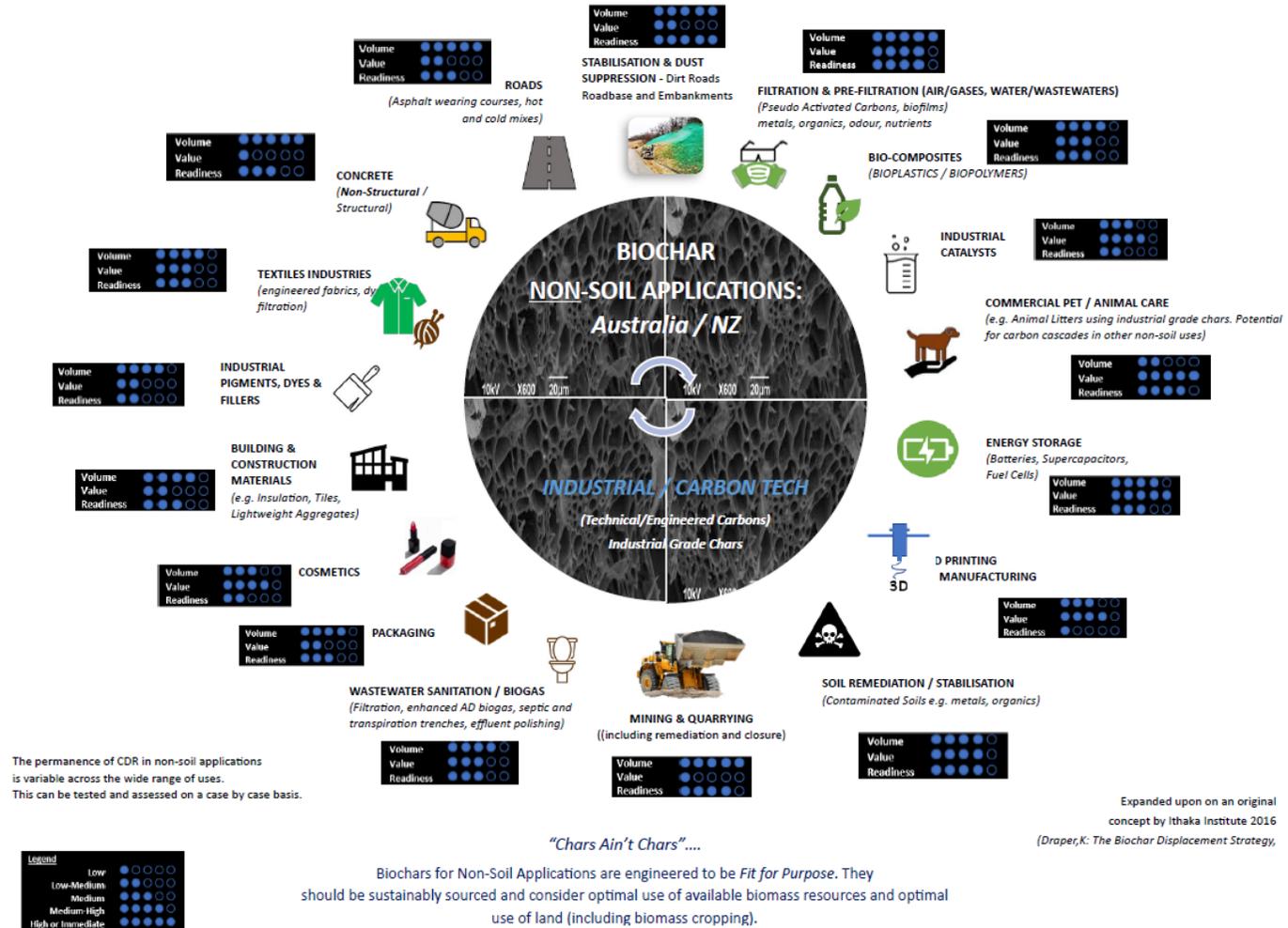
Note: Many soil applications provide long term CO<sub>2</sub> Removal (CDR), but can vary for specific applications, which should be assessed on a case by case basis.

Figure 4: Soil Applications for Biochars (including both Urban and Rural Uses)

### Other Non-Soil Uses of Biochar and Biocarbons

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

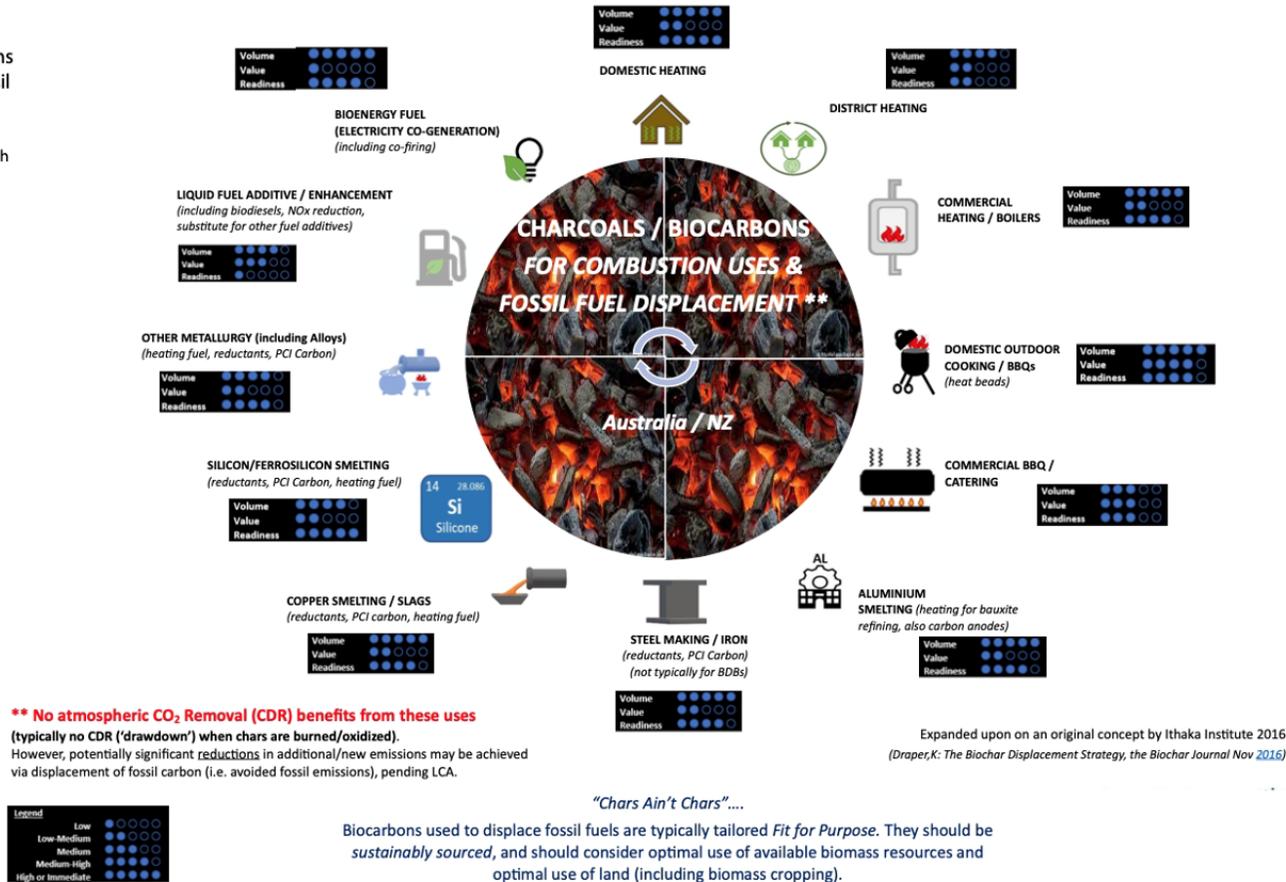
Source: Catalyst Environmental Management with support from South East Water Expanded on an original concept by Ithaka Institute (Draper,K, The Biochar Displacement Strategy, The Biochar Journal, 2016)



**Figure 5: Industrial / Non-Soil Applications for Industrial-Grade Biochars/Circular Carbons**

**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)



**Figure 6:** Combustive and Oxidative Use for Circular Carbons (e.g. Biocarbons) These displace fossil fuels to reduce emissions but do not provide any significant durable carbon removal benefit (no CDR)

### Towards a Circular Economy and Net Zero Through Stewardship of Carbon from Biomass

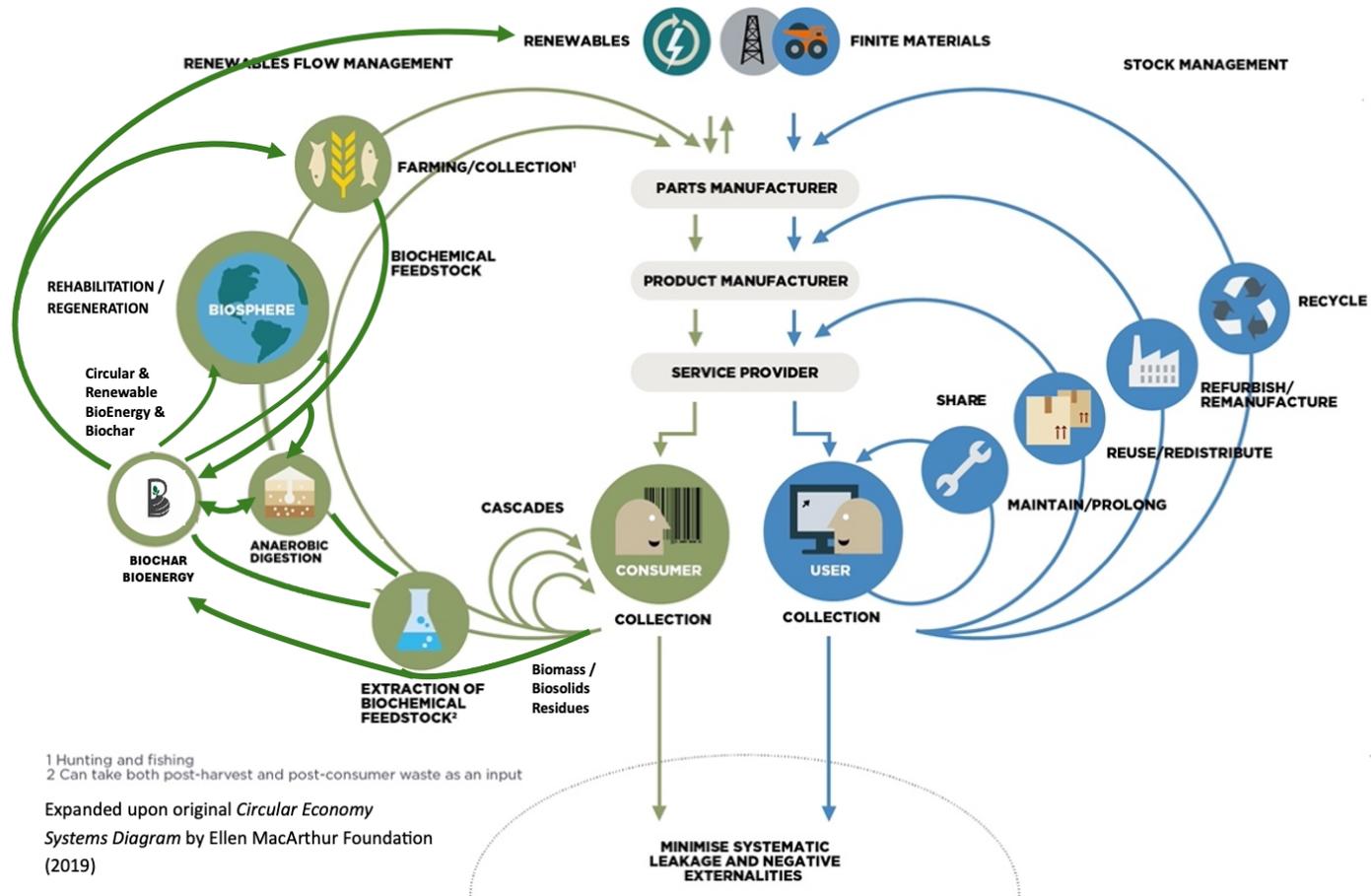


Figure 7: Revised Butterfly Diagram for Circular Economy

## Specific Comments on GISA’s Draft Strategy

ANZBIG generally supports the Draft Strategy overall and most of its detailed actions, and we commend GISA’s efforts in developing integrated, practical and robust strategies to benefit South Australia. Notwithstanding this, despite the positive findings and recommendations of a recent SA Parliamentary Inquiry into Biochar (Appendix 1c), ANZBIG note the Draft Strategy still does not mention biochar at all. Given the very significant potential for circular carbon benefits via biochar, ANZBIG calls for this unfortunate omission to be rectified as a priority action.

The following comments are intended to supplement, not criticise, key aspects of the Draft Strategy, as we believe the Draft Strategy is quite substantive and effective in providing a path forward for SA and the South Australian Government. We welcome any opportunity to answer questions, address comments and collaborate moving forward as South Australia helps to progress a circular economy.

### Circular Economy Principles

We appreciate that the Draft Strategy’s approach to a circular economy reflects the third, often-overlooked, pillar of circular economy, regenerating nature (p.6),

*“Circular economies shift the focus from extraction of natural resources to regeneration of nature through reducing the use of virgin resources, reducing waste and pollution, and returning valuable organic materials and nutrients to soils.”*

Biochar is commonly used to restore degraded soils and filter contaminated water, helping to regenerate these important agricultural resources. Further, the water industry has identified that thermal treatment of biosolids to address emerging contaminants can help facilitate continued circular return of critical phosphorous nutrients to Australian agricultural soils that is otherwise lost in a linear process.

**Figure 7** illustrates how this aspect can be more effectively integrated in the traditional model of the circular economy.

ANZBIG fully supports the Draft Strategy’s statement (p.6) that,

*“Achieving [a circular economy] will require systems-wide approaches with cooperation up, down and across supply chains to share resources, design better goods and services, and innovate. Large-scale change is always disruptive, and shifting to a more circular economy will require coordinated action, commitment, and investment. It will also require policy settings and tools that support this kind of collaboration and shared action.”*

This is exactly what ANZBIG, local governments, and aligned industries including water and forestry have been saying in the Roadmap and various submissions to governments across Australia.

### Focus area 1: Avoid waste

While the 11R circular economy strategies illustrated in **Figure 1** and the waste management hierarchy (p.74) of the Draft Strategy provide useful guides, **we believe the Resource and Energy Recovery Hierarchy in Appendix 4 provides a more useful means of integrating some of these key concepts and we urge GISA to consider using it in finalising the strategy and all future deliberations.** Facilitating circular carbon systems and designing out sources of linear organic waste streams can facilitate waste avoidance concepts, displacing linear single use wastes for disposal and replacing them with circular carbon resources via biochar bioenergy systems. Circular carbons in

solid, liquid and gas form can displace fossil carbons and concurrently linear single use waste disposal (including linear EfW).

### **Focus area 2: Reduce food waste**

Whilst ANZBIG supports the Objectives and Actions in Focus Area 2 of the Draft Strategy, we note the important role that biochar can play in integrated systems to address organic wastes in circular ways, including food waste on its own and food waste as part of food organics garden organics (FOGO) systems. Most importantly, local government areas have been legislated at national level to divert organics from landfill by 2030, however they are constrained in two critical ways by conventional diversion options into biological processing. Firstly, turning all diverted organics into conventional circular products (e.g. mulch and compost) is effectively an “all eggs in one basket” solution with minimal risk diversification and resilience. Options to diversify the number of market outlets for recovered organics is a positive consideration – circular market uses for biochar in soil and non-soil/industrial applications are very diversified. Secondly, conventional biological processes are threatened and constrained by emerging contaminants, particularly ‘Forever Chemicals’ (PFAS) and microplastics among many others. **As now widely recognised globally, thermal processes to make biochar can successfully deconstruct organic emerging contaminants such as PFAS and microplastics safely, effectively upcycling the waste feedstock to higher value applications than disposal. As such, backing the biochar industry and its Roadmap would significantly assist local governments across SA to divert organics effectively from landfill whilst concurrently managing these risks.**

### **Focus area 3: Reduce material loss and preserve value**

ANZBIG supports the Objectives for Focus area 3, namely:

*“Support a circular economy through the application of best practice waste management and resource recovery that:*

- *maximises the safe recovery of recyclable materials*
- *provides for separation of materials as close as possible to the point of generation*
- *minimises contamination of recyclable materials*
- *maximise recycling efficiency at all stages (collection, preprocessing – including separation and sorting – and end processing) to reduce material losses*
- *enables the safe and beneficial use of recycled materials, achieves the highest value reuse, and does not pose a risk of environmental harm.”*

The wide range of types and scale of biochar production technologies facilitates solutions to waste circularity close to the point of generation, upcycles wastes contaminated by organic pollutants (e.g. PFAS, pesticides, herbicides, pharmaceuticals etc) and enables safe and beneficial reuse of circular carbons to displace fossil carbon use throughout the economy. The *Australian Biochar Industry 2030 Roadmap* details how the production and use of biochar helps to deliver against these objectives.

### **Focus area 5: Develop and support circular markets and businesses**

ANZBIG fully supports the Draft Strategy’s statements (p.54) that,

*“The business sector is essential to the transition to a circular economy, as this is the point at which many of the critical design and production decisions are made. The benefits to businesses in becoming more circular are not just environmental, but can include new market opportunities, increased resilience and supply chain security, reduced operating costs, and employee attraction and retention. Lean manufacturing improves resource efficiency, which*

*can increase productivity and reduce business costs. Businesses can also explore alternate value creation models that are in line with a circular economy, such as through ISO 59010:2024: Circular economy – Guidance on the transition of business models and value networks.*

*Collaboration with other businesses can also provide opportunities to increase circularity, whether this be in their purchasing practices in their supply chain, or as part of a circular precinct or ecosystem where waste from one business becomes a resource for another, creating closed loops of material and energy flow. Through collaboration, businesses can work together to reduce waste, maximise resource use and material productivity, and create value in a sustainable way.*

*Just like there is no one type of business, there is no single approach for businesses to become more circular. Small to medium businesses in particular need support to make these changes, through practical and tailored assistance to capitalise on circular opportunities, and investment which supports high circularity outcomes.”*

We appreciate that the South Australian Government understands and articulates these key concepts in the Draft Strategy.

The *Australian Biochar Industry 2030 Roadmap* incorporates these key concepts, and ANZBIG has fostered significant collaboration between allied industries to enhance circular carbon via biochar bioenergy technologies. ANZBIG recommend supporting and funding rollout of the Roadmap to help the South Australian Government actively deliver against key objectives of the Draft Strategy, including moving towards net zero and a circular economy in the manners described. **Nationally, ANZBIG is seeking \$150 million in investment to implement the Roadmap, which we note is expected to facilitate a potential \$13 billion industry nationally as a “budget-positive” investment to boost economic productivity. The \$150 million investment in the industry is around only 7% of the amount Denmark is investing in biochar just for its *agricultural sector* alone.**

**Our Roadmap strategy aims to develop the industry to potentially pyrolyse up to 50 million tonnes of biomass waste per annum to mitigate 10-15% of Australia’s greenhouse gas (GHG) emissions by making 15 million tonnes of biochar potentially worth \$5-7.5 billion per annum, while producing 300 million GJ of energy potentially worth \$5 billion. Accordingly, the Australian biochar industry has the potential to be worth at least \$13 billion per annum to the national economy.**

Biochar is being used or proposed in a range of key sectors, including to:

- **achieve the Australian Government’s Agricultural Productivity Target, whilst recycling carbon and improving soil natural capital;**
- **decarbonise hard to abate industrial sectors and the built environment, including roads, concrete, steel and more;**
- **support restoration of degraded and marginal lands, including mine site rehabilitation;**
- **Treat and safely deconstruct emerging contaminants such as PFAS and microplastics which can be present in a range of organic wastes and are increasingly constraining options for beneficial reuse (e.g. biosolids, FOGO, compost).**

Of the stated Objectives for Focus area 5, ANZBIG especially notes the significance of the following (p.54):

- *“Maximise resource efficiency in production and consumption through using recycled materials, minimising the generation of waste and preventing the release of hazardous substances throughout the life cycle of products and materials*
- *Increase end markets for recovered resources*
- *Boost economic growth and generate more circular economy businesses and jobs”*

We refer to the substantial range of end use markets demonstrated for biochar in **Figures 4,5,6** and urge GISA to explore the many opportunities that these can provide, noting that the Draft Strategy calls for increased circularity in many of these sectors (e.g. built environment (in Focus area 6) for biocarbons and other bioproducts as well, specifically including roads, concrete, steel, industrial filters and a range of other items. These are often aligned with other uses of recycled materials.).

To achieve accelerated use and deliver against these other objectives a range of supportive measures can be adopted, many of which are outlined in the *Australian Biochar Industry 2030 Roadmap*. For example:

- **Supporting commercial scale demonstrations** of biochar use to promote awareness of the ‘the business case for biochar’ at genuine commercial scales (Initiative 4 of the Roadmap).
- **Supporting Education and Awareness measures (Initiative 2 of the Roadmap)**. The ANZBIG Farmers Guide includes a range of case studies providing examples of this.
- **Provide economic and policy incentives for production and use/procurement of circular carbon products (Initiative 9 of the Roadmap)**. A number of international policies exist that subsidise biochar use for a range of markets which should be similarly considered here. ANZBIG believes that a policy that subsidised biochar use could significantly assist growth of the industry.
- **Provide no/low interest loans to biochar projects (production and use) – “HECS for Clean Tech”** allowing the industry to back itself and pay back loans once they are established, just as a professional degree is paid back by a graduate through their taxes as they establish their career.

#### **Focus area 9: Contribute to net zero emissions**

ANZBIG notes the significance of negative emissions technologies (NETs) in delivering net zero targets. **Emissions reduction (reducing new and additional fossil carbon emissions) is crucial, however the IPCC has identified that CO<sub>2</sub> Removal (CDR) is now critical – we need both:**

*“The deployment of CDR to counterbalance hard to abate residual emissions is unavoidable if net zero (CO<sub>2</sub> and total GHG) is to be achieved.”* IPCC 6<sup>th</sup> Assessment Report April 2022

**7–9 Billion tonnes per year of CDR is estimated to be required by 2050 to meet the 1.5°C target (State of Carbon Dioxide Removal report (2nd Edition, 2024)). Current anthropogenic CDR processes are estimated at <1.5 Million tpa. Biochar production and use is one of the most cost-effective NETs available, providing both ER and CDR to aid the transition to net zero. Actions to support rapid scaling of the industry should therefore be supported.**

GISA’s Draft Strategy recognises wind turbines and solar, but does not recognise the significant renewable and consistent energy that pyrolysis technologies can provide from every 1,000 tpa of biomass pyrolysed, 1,000kw of energy can be produced (approx. \$1 million in energy). Pyrolysis and gasification technology providers are being approached by renewable and alternative energy companies because of our significant consistent energy that is not reliant on wind or power, but by running the technology.

**We suggest that waste levy proceeds should be directed to accelerating circular solutions to waste disposal, including emerging innovation, as part of implementing Actions in the Draft Strategy to help achieve circular economy and net zero.**

- Implement the *Australian Biochar Industry 2030 Roadmap* to enable circular carbon resources.

- A dedicated fund could be established use waste levy resources to fund a range of circular solution initiatives, such as “HECS for Clean Tech”, whereby emerging clean technologies can access no/low interest loans to back themselves to cross the ‘valley of death’. Typically, conventional debt funding (from banks etc) is not readily available to fund pre-commercial actions required to accelerate commercialisation (e.g. project pre-feasibility and feasibility studies, approvals, tests and trials/demonstrations etc). Government support to bridge these critical financial gaps could rapidly accelerate the industry.
- One of the critical costs of development for emerging circular solutions is testing and validation in terms of both labour costs and analyses (laboratory and in situ/’real time’ analysis). The waste levy could be leveraged to provide government (or 3rd party) services such as mobile testing vehicles to undertake such testing and validation to required standards for both the production and use of circular materials (such as circular carbons and others identified in the Draft Strategy). This could significantly accelerate commercialisation.
- Government Guarantees – as done during the Covid Crisis, to address the Climate Crisis government could provide risk guarantees (only) for defaults in commercial offtake agreements. This would rapidly accelerate availability of conventional debt financing and investment into the establishment of new facilities to provide circular solutions to waste. Again, waste levy funds could be used to cover such a program to enable circular solutions.
- ANZBIG believes that a policy that subsidised biochar use would go a long way to our roadmap goals, specifically as the end use markets are still maturing and need development. While there are over 40,000 published papers on biochar benefits and applications for soils and industrial use, the largest barrier to getting projects up is biochar sales and markets. This is why the Australian Biochar Industry 2030 Roadmap has a dedicated focus to measures to assist this critical development area and requires funding to do so.

ANZBIG suggests that GISA ensures the integration of biochar, biocarbons and other bioproducts on Actions 9.2 – 9.4, noting the work done recently around carbon accounting methodologies and the opportunity to more effectively count the contributions of negative emissions processes.

### **Energy from Waste (EfW)**

The Draft Strategy refers to the growing interest in EfW in SA as relating to tackling the amount of residual waste going to landfill; this is mainly with regard to municipal solid waste (MSW), and not to the agricultural residues, forestry residues, grape marc, biosolids and other biomass co-feedstocks regularly involved in the production and use of biochar, biocarbons and other bioproducts resulting from pyrolysis and gasification. We note how defining and regulating these materials as ‘wastes’ belies that they are not normally sent to landfill, and various productive uses are available if they are seen more as resources or co-feedstocks. Notwithstanding this, **the organic fraction of “red bin waste” (often referred to as mixed waste organics, MWO) currently landfilled is significant and represents a potential significant opportunity for diversion and recovery. Pyrolysis and gasification technologies can address emerging contaminants such as PFAS and plastics residues that commonly constrain MWO from direct reuse particularly for land applications. Thermal treatment can safely upcycle these for suitable end uses including (at minimum) industrial grade applications among others.**

ANZBIG’s *Decoupling Policy Paper* (refer Appendix 2) addresses a wide range of considerations for EfW that are directly relevant to the Draft Strategy. The *Decoupling Policy Paper* examines the necessity of separating regulation of linear EfW (full combustion and incineration) from more circular and regenerative thermal treatment systems for biochar, bioenergy, renewable fuels and chemicals (such as pyrolysis and gasification). The *Decoupling Policy Paper* emphasises the

positive implications for action on climate change, circular economy, air quality and waste management, among other factors. These alternatives can halve emissions compared to conventional combustion EfW approaches whilst concurrently generating energy and circular carbon materials for a wide range of end use applications to further displace fossil carbon. The ANZBIG *Decoupling Policy Paper* proposes a modified Resource and Energy Recovery Hierarchy (to accompany the conventional Waste Hierarchy commonly used to assess ‘higher order use’ of resources) which builds upon precedent concepts for circular liquid fuels in the Queensland Energy From Waste Policy by additionally recognising the value of circular carbon in solid form (e.g. biochar) and gas form (e.g. syngas and derivatives).

### **Circular Procurement and Government Investment**

**Additionally, we suggest the following recommendations could enhance circular economy and accelerate decarbonisation efforts:**

- **Increase government procurement** of low carbon products and services (including those using CDR) across the economy, including transport and associated infrastructure. Government-created demand through targeted decarbonisation mandates reducing fossil carbon content would drive confidence and market certainty. Design of a mandate, standards, targets and/or other demand options should all include requirements for a certain proportion of Australian circular carbon product (including biochar) - creating demand for Australian produced circular carbon, *‘Made in Australia’ for Australia*.
- **Establish Carbon Dioxide Removal (CDR) targets to complement Emissions Reduction targets in government policy** to drive investment in CDR applications to accelerate decarbonisation toward genuine Net Zero by 2050. This should include setting **interim targets** for 2030 ahead of Net Zero by 2050.
  - **Incentivize ER and CDR achievement**, with baseline incentives for minimum targets (with support granted where increased actions are *completed* toward targets), and higher incentives for above-target emission reductions and CDR.
- **Encourage the Commonwealth Government to Adopt the proposed Biochar ACCU Methodology**, which could help government agencies and private sector companies to procure low carbon CDR products and services (including carbon *negative* hydrogen and LCLF) that can measurably assist their decarbonisation and Net Zero commitments (government agencies would benefit highly from ACCUs as policies may inhibit use of Voluntary Carbon Market credits, unlike the private sector).
- **Develop enhanced mechanisms to provide low-cost capital** into the renewable fuels, biochar bioenergy sector, in particular for new and emerging innovation to aid commercialisation. This should include a range of:
  - low/no interest loans
  - advocacy for significant and rapid tax incentives (state/Commonwealth)
  - grants with alternatives to matched co-funding, recognition of existing capital investment by proponents and ability for founding directors to work on grant projects, and alternatives to academic partnership requirements which currently inhibit private sector take-up. Grant funding currently appears to dominate into inefficient long term research-driven programs compared to more efficient, outcomes-driven private sector demonstration and commercialisation. Increased focus on the latter for balanced funding could potentially realise more rapid commercialisation for genuine decarbonisation outcomes for Australia.

- **Offtake and procurement support/biochar subsidy** - It would be most advantageous if proposed projects could be guaranteed commercial viability/offtakes *for a stipulated timeframe* through government support mechanisms (“cradling”). Feedstock price and offtake price could be set to ensure commercial viability to encourage further development and scale up. Projects would still need to raise capital but could do so in an environment of *certain profitability for a set timeframe* – recognising a necessary timeframe of steady returns on the capital outlay. Government procurement could also be integrated and utilised to help facilitate this. Sound technologies, well managed, would thrive in such environment and advance relatively quickly, shining a light on the best pathways and technologies.
- **Support commercial scale demonstrations in all states** of circular carbon products and services (including those using CDR) throughout the economy.
- **Support innovation pathways and government/3<sup>rd</sup> party independent testing** to validate and accelerate new low carbon technologies, products and services used by the transport and infrastructure sector that would otherwise arrive to market far later without such support. Support for associated national/International standards and certifications where relevant.
- **Support and enhance awareness and education** of low carbon products and services (solids, liquids and gases) using biochar CDR and bioenergy, including case studies and business cases to leverage and showcase commercial scale demonstrations (noted separately above). Support for public messaging to build ‘social licence’ regarding the benefits of local biochar and circular carbon industries that include regenerative farming, marginal land cropping, jobs for rural Australia, cleaner plane travel and independent fuel security and resilience for Australia.
- **Advocate for re-direction of existing fossil fuel rebates** (e.g. fossil diesel rebates) from major fossil industries into renewable circular carbon products that displace fossil carbon could significantly assist with supporting uptake of these sustainable low carbon commodities in lieu of traditional fossil carbon products. Different rates of incentive could be utilised to prioritise alignment and timing if/as desired.
- **Support ANZBIG and the Australian Biochar Industry 2030 Roadmap** – The biochar bioenergy sector and its roadmap for industry scale up to help Australia decarbonise is yet to receive any significant government support. The Roadmap outlines 10 key Initiatives and supporting actions (some of which contribute to the dot point recommendations earlier above) to scale the industry to potentially reduce Australia’s net carbon emissions by 10-15% and provide up to 20,000 permanent jobs, including in rural and regional areas.

## **APPENDICES**

**Appendix 1: South Australian Parliamentary Inquiry into Biochar**

*(refer separate documents provided for this Appendix)*

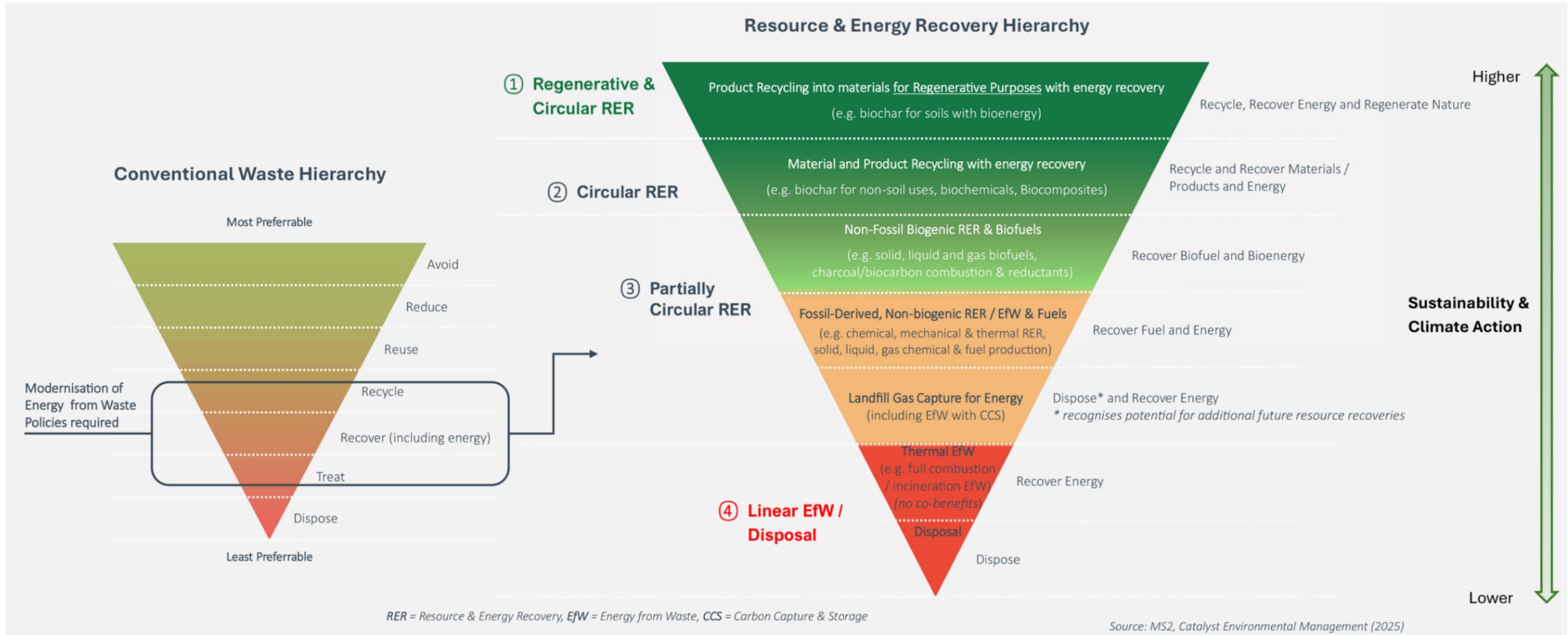
**Appendix 2: Australian Biochar Industry 2030 Roadmap (V2 Aug 2024)** – including alignment with national policies

*(refer separate document provided for this Appendix)*

**Appendix 3: Decoupling Policy Paper** – *‘Modernising Resource Recovery and Energy Policies  
- Decoupling Biochar Bioenergy Systems from Linear Energy from Waste Systems for Circular  
and Regenerative Benefits’*

*(refer separate document provided for this Appendix)*

Appendix 4: Resource and Energy Recovery Hierarchy (A3)



Example similar existing precedent (Qld EfW Policy 2021):

Existing EfW Hierarchy (Qld, 2021):

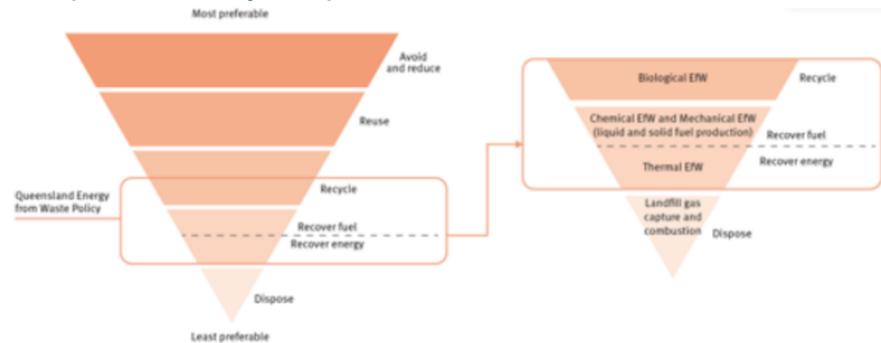


Figure 3: Waste and Resource Management Hierarchy (left), and EfW Hierarchy for residual waste (right) for Queensland

← Currently recognises circular carbon **liquids + EfW** as Higher Order Uses, but **not yet** circular carbon **solids (biochar)** or **gases (syngas) + EfW** for additional resource recovery / 'chemical recycling' + EfW across all 3 physical phases (S, L, G)

**Appendix 5: Water Industry (WSAA) Submission to CEMAG – ‘Help Us Help You’ (2023) –  
Opportunities Technical Papers – Opportunity 1: Biochar**

*(refer separate document provided for this Appendix)*