ANZBIG SUBMISSION:

Independent Review of Australian Carbon Credit Units (ACCU)

26th September 2022

Thank you for the opportunity to provide comments on the Independent Review of Australian Carbon Credit Units (ACCU), on behalf of the Australian New Zealand Biochar Industry Group (ANZBIG). This submission follows previous detailed submissions by ANZBIG on the ERF Methods Scoping Paper for CCS/CCUS (7th August 2020) and the Soil Carbon Method (27th September 2021). These should be referenced for further details including information on carbon abatement potential, permanence, additionality, alignment with the UN Sustainable Development Goals (SDGs) and potential to enhance regional economies and job creation (among others).

ANZBIG encourages the panel to recognise the benefit of developing an ERF method for biochar.

Biochar is a relatively stable, carbon-rich material produced by heating sustainably obtained biomass under controlled low oxygen conditions using a clean technology. Biochar can be made from many under-utilised biomass feedstocks, such as crop straws, forestry residue, manure, urban green waste and biosolids among many others.

Biochar can be used as a **soil amendment** (including in urban uses), as recognised by the European Union (July 2021) through establishment of a framework for biochar use in agricultural fertilisers. Biochar can also be used in a range of **non-soil applications** to displace fossil-fuel derived carbon which provide multiple benefits. For example, in water management, road construction, cement, building materials and multiple carbon products. Accordingly, there are readily available opportunities in multiple applications using biochar to be included under the ERF which offer significant socio-economic and environmental co-benefits to Australia.

Biochar has been recognised by the IPCC as an effective method for climate change mitigation, providing both emissions reduction and carbon dioxide removal, with potential abatement of up to 6.6 Gt CO2e per annum globally (IPCC, 2022).

A method for estimating climate change mitigation through pyrolysis of biomass has been developed by the **IPCC**, that could be used to include biochar in Australia's national greenhouse gas inventory (IPCC, 2019). A refined method has been published by the same authors in Woolf et al. (2021). Methodologies for biochar have been developed for a number of voluntary emissions trading platforms, for example including **Puro.earth** (https://puro.earth/carbon-removal-methods/), **Verra** (https://verra.org/methodology/methodology-for-biochar-utilization-in-soil-and-non-soil-applications/) and **Carbon Futures** (https://www.carbonfuture.earth/resources). A proposal for a biochar method was also developed for the Carbon Farming Initiative in 2013, under a grant from DISER. These sources form a strong basis for development of an ERF method for biochar.

There is sound scientific understanding of biochar production and use, particularly its interactions with soil and plants, with 20 years of research summarized by Joseph et al. (2021). When applied to

[1] *formerly known as the Australia New Zealand Biochar Initiative (ANZBI)*

soils biochar persists from decades to thousands of years depending on feedstock and production conditions. Additional mitigation benefits can be delivered through lower soil N_2O emissions; reduced nitrogen fertiliser requirements due to reduced nitrogen leaching and volatilisation from soils; "negative priming" whereby biochar stabilises newly added plant organic matter (further detailed in a paper published in Nature Climate Change by Zhe (han) Weng et al in 2017); and reduced GHG emissions from compost when biochar is added.

The pyrolysis process produces a combustible syngas co-product, that can be used for renewable energy, displacing fossil fuels. Potential **non-climate co-benefits** from land application of biochars include yield increases particularly in sandy and acidic soils; increased water-holding capacity; adsorption of organic pollutants and heavy metals; rehabilitation of degraded land; management of biomass wastes; odour reduction from manure handling; and reduction of forest fuel loads. The attainable benefits vary depending on the specific feedstocks and applications.

Barriers to realizing the potential benefits from production and use of biochars include limited investment, a handful of large-scale production facilities in Australia, and high production costs at small scale. An ERF method for biochar would encourage investment that would support upscaling through provision of affordable biochar products.

The emerging ANZ biochar industry has recognised the need for quality control of biochar products, and has developed an industry *Code of Practice* that specifies characteristics for different categories of biochars, intended for different applications. Other biochar standards include the European Biochar Certificate standard and the International Biochar Initiative standard. This includes reliable test methods for measuring biochar persistence (e.g $H:C_{org}$ ratio) which are now well demonstrated and recognised, as used by the two existing methods for biochar on the voluntary markets referred to earlier above and including in the ANZBIG *Code of Practice* (2021).

ANZBIG would welcome the opportunity to discuss with the review panel and to work with CER to develop an ERF method for biochar. ANZBIG also re-confirms recommendations made in previous submissions in 2020 and 2021 which we would also be happy to further discuss with the review panel.

An outline of biochar as a Carbon Capture and Utilisation (CCU) technology, and relevant information for context to the ERF are provided in our related submissions in 2021 and 2020. Further details are also provided within ANZBIG's submissions on the national ***Bioenergy Roadmap*** and ***Technology Investment Roadmap*** in 2020, available on our website www.anzbig.org/resources.

Carbon Abatement Potential Of Biochar

The growth of biomass is considered the most efficient and feasible method currently available to extract carbon dioxide from the atmosphere. However, fresh or untreated biomass is easily degraded by microorganisms, releasing carbon back to the atmosphere in the form of greenhouse gases as part of the natural *carbon cycle*. Alternatively, when biomass is pyrolyzed, the organic carbon is converted into **solid** (biochar), **liquid** (bio-oil/wood vinegar), and **gaseous** (pyrogas/syngas) **carbonaceous products for various uses**.

A comprehensive study of the global potential for abatement through biochar, published in the prestigious journal *Nature*, found that producing **biochar from biomass** (such as organic waste that does not compete with food production or increase land use) **could sequester the carbon equivalent to 12% of total global CO_2 emissions at that time**, which was **on par with offsetting emissions from**

the entire global transport sector. For relative context, global biochar production (led by China) is still ~<1% of the volume of biomass being wasted annually in Australia alone.

The feasible abatement potential of biochar in NSW alone has been estimated at **1.6 Million tonnes CO_2e per year** (Waters et al., 2020), equivalent to taking nearly ~350,000 passenger vehicles off the road (USEPA, 2018), based on conservative assumed use of 10% of crop residues, 50% of feedlot manure and poultry litter, and 90% of processing residues (nut shells, gin trash, rice hulls) and urban greenwaste.

Theoretical Potential For Biomass to Biochar and Bioenergy in Australia:

The theoretical potential for unused biomass conversion to biochar and its co-products in Australia is estimated below (ANZBIG 2020):

Up to ~50-100 Million metric tonnes per year of **residues no longer burned/landfilled***

- **Up to ~15-30 Million** metric tonnes per year of **biochar potentially produced**
  - Biochar saleable economic value **$7.5B-$15 Billion** (@AUD $500/t)
  - Additional carbon credit value (current market value) **$1.5-$3 Billion** (@ AUD$100/t)**
- **>Up to ~30-60 Million** metric tonnes/y CO_2e of **CO_2 removal (Negative Emissions/Drawdown)**

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

** Australian Energy Resources Assessment estimated in 2016 that biomass residues/waste nationally were >75M tpa. Crawford et al 2015 estimated biomass residues conservatively at 80Mtpa, which could grow to 110-115Mtpa by 2050.*
***** Conservative estimate on current markets.** Puro Earth CORCs credit value June 2020: Euro €30/t CO_2e (~AUD $48/t CO_2e @ exchange rate 1.6) and typical >3t CO_2e per tonne of biochar, ➔ i.e. current credit value June 2020 AUD **~$140/t biochar**. For further relative context, the Stripe project in USA recently paid over **USD $100/t CO_2e** for (non-biochar) voluntary market carbon sink products, **nearly triple** the conservative estimate above.* https://stripe.com/blog/first-negative-emissions-purchases

The IPCC has also stated that ***lack of action to address land degradation will increase emissions and reduce carbon sinks, and is inconsistent with the emissions reductions required to limit global warming to 1.5°C or 2°C. Better management of soils can offset 5–20% of current global anthropogenic GHG emissions****. Measures to avoid, reduce and reverse land degradation are available but economic, political, institutional, legal and socio-cultural barriers, including lack of access to resources and knowledge, restrict their uptake.* Joseph et al (2021) describe how biochar can improve land productivity, and the Biochar for Sustainable Soils project demonstrated the role of biochar in sustainable land management. **Soil carbon** (Soil Organic Carbon) plays a key role in soil productivity and represents the largest terrestrial sink for carbon. Improving agriculture to build soil carbon is one of the best options for reversing climate change while supporting sustainable farming. ***A 1% increase in SOC in the top 30 cm of soil translates to sequestration of approximately 165 tCO_2e per hectare*** assuming bulk density of 1.5t Soil/m^3 *(Soil Carbon Industry Group, 2020)*.

Importantly, biochar has also been shown to **increase soil carbon in excess of the carbon added in biochar itself** ('negative priming'), as demonstrated in this decadal study published in the respected scientific journal *Nature* (Weng et al 2017). Further, a new paper published in Nature Communications by Zhe (Han) Weng et al September 2022 details the mechanisms whereby biochar assists expansion of soil organic carbon.

Accordingly, the development of CCUS methods for biochar and bioenergy applications under the ERF could significantly, quickly, and cost-effectively increase both emissions reduction and carbon dioxide *removal* benefits, providing significant 'bang for buck' to leverage government investment. ANZBIG would welcome the opportunity to discuss this further with the Department.

Thank you again for the opportunity to provide comment, we look forward to further discussion.

Kind Regards,

Don Coyne

Executive Director, ANZBIG

Nigel Murphy

Chair ANZBIG, Chair Victorian Clean Technology Cluster

Director / Principal Environmental Scientist, Earth Systems

Professor Annette Cowie

Adjunct Professor University of New England

IPCC Lead Author: Special Report on Climate Change and Land and Working Group III - Sixth Assessment Report

Craig Bagnall

BE(Env), CEnvP(IA Specialist)

Director Environment & Regulatory

SEATA Group

On behalf of the ANZBIG Advisory Board

ANZ Biochar Industry Group (ANZBIG)

Contact: c/o Don Coyne, Executive Director

Email: execdirect@anzbig.org

References:

IPCC 2019 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use Chapter 2 Appendix 4
https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch02_Ap4_Biochar.pdf

IPCC 2022 Climate Change 2022: Mitigation of Climate Change Chapter 7
https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Chapter_07.pdf

Joseph, S., Cowie, A.L., Van Zwieten, L., Bolan, N., Budai, A., Buss, W., Cayuela, M.L., Graber, E.R., Ippolito, J.A., Kuzyakov, Y. and Luo, Y., 2021. How biochar works, and when it doesn't: A review of mechanisms controlling soil and plant responses to biochar. *GCB Bioenergy*, *13*(11), pp.1731-1764. https://doi.org/10.1111/gcbb.12885

Woolf, D., Lehmann, J., Ogle, S., Kishimoto-Mo, A.W., McConkey, B. and Baldock, J., 2021. Greenhouse gas inventory model for biochar additions to soil. *Environmental Science & Technology*, *55*(21), pp.14795-14805. https://doi.org/10.1021/acs.est.1c02425

Zhe (Han) Weng, Lukas Van Zwieten, Ehsan Tavakkoli, Michael T. Rose, Bhupinder Pal Singh, Stephen Joseph, Lynne M. Macdonald, Stephen Kimber, Stephen Morris, Terry J. Rose, Braulio S. Archanjo, Caixian Tang, Ashley E. Franks, Hui Diao, Steffen Schweizer, Mark J. Tobin, Annaleise R. Klein, Jitraporn Vongsvivut, Shery L. Y. Chang, Peter M. Kopittke & Annette Cowie, September 2022, *Microspectroscopic visualization of how biochar lifts the soil organic carbon ceiling*, Nature Communications volume 13, Article number: 5177 (2022). https://www.nature.com/articles/s41467-022-32819-7

Zhe (Han)Weng, Lukas Van Zwieten, Bhupinder Pal Singh, Ehsan Tavakkoli, Stephen Joseph, Lynne M. Macdonald, Terry J. Rose, Michael T. Rose, Stephen W. L. Kimber, Stephen Morris, Daniel Cozzolino, Joyce R. Araujo, Braulio S. Archanjo and Annette Cowie, April 2017, *Biochar built soil carbon over a decade by stabilizing rhizodeposits*, Nature Climate Change (DOI: 10.1038/NCLIMATE3276). https://www.nature.com/articles/nclimate3276