Statement – Roundtable on novel negative emissions approaches for Australia

The concentration of greenhouse gases (GHGs) in Earth's atmosphere must be reduced if there is any hope of limiting the global average temperature increase to close to the 1.5°C lower limit stipulated in the Paris Agreement.

In Australia, much of the discussion has focused on achieving 'net zero' by 2050. This will require removal of GHGs from the atmosphere to offset difficult to abate sectors like steel or concrete production. Removals will have to increase further if we are to limit global warming to 1.5°C.

Reducing GHG emissions as much and as fast as possible is the highest priority. In parallel, we need rapid and large-scale removal of GHGs from the atmosphere, combined with long-term storage.

Of the present methods used for removal of GHGs (primarily CO_2) and their long-term storage or utilisation, none are at the scale required.

How do we develop the capacity to drawdown GHGs at a globally effective scale while reducing emissions to close to zero? Do we have the knowledge and science capability?

A roundtable on novel negative emissions approaches for Australia was organised on Friday 16 September 2022 by the Australian Academy of Science.

Methods that remove greenhouse gases from the atmosphere, and store (for thousands to millions of years) or use them (at sufficient scale and as part of a circular economy) are described as achieving 'negative emissions'.[1]

The aim of the roundtable was to discuss the science that would enable breakthroughs to meet the scale of the removal challenge, the research needed, the cooperation and investment required to deliver the means to the essential end – a liveable and more sustainable planet.

Professor Chennupati Jagadish AC PresAA FTSE, President of the Australian Academy of Science, chaired the online invitation-only roundtable. Participants joined from across Australia and comprised of experts in GHG removal, storage and use, climate and environmental science, climate policy and governance and innovation policy.

Participants identified a range of novel approaches across capture, storage, utilisation and monitoring. These are new areas of research that could prove fruitful, but are currently not a core part of the negative emissions discussion. Some of the approaches discussed included directly splitting carbon dioxide into elemental carbon, ocean alkalinity enhancement, and using zeolite to capture methane. Novelty also included using existing technologies in new ways.

Critical principles that new approaches should meet were also identified. Their impact should be measurable, scalable, affordable and permanent. They should provide social, economic and

environmental co-benefits, and limit externalities and future risk. A wide range of options should be explored as part of a portfolio of solutions. New approaches should be adopted where they best suit specific social, environmental, economic and political contexts.

The roundtable identified the following opportunities:

1. **Research – coherence and focus in Australia's research effort**

- Establish a means to foster interdisciplinary research and collaborative networks.
- Invest in human capital, especially young researchers.
- Improve data and knowledge sharing between research, government and industry.
- Examine the societal aspects of negative emissions development and implementation.
- Develop a comprehensive understanding of climate change impacts and adaptation on GHG removal capability.
- Establish a collective voice and a common terminology to facilitate clear and productive discussion.

2. Society

- Engage early and continuously with policymakers and communities, especially First Nations peoples, to co-design appropriate approaches to negative emissions portfolios.
- Build community confidence in the benefits and risk management to support GHG removal.
- Build the social licence for negative emissions activities.

3. Policy

- Improve holistic assessment of the benefits, risks and limitations of removal of CO_2 (and other GHGs), storage and uses to inform policy development.
- Create the innovation and regulatory environment to accelerate the development of new approaches, and to attract private sector investment.
- Build vital strategic coordination and connection between knowledge generation and policy development.

The Australian Academy of Science will produce a full report on the outcomes of the roundtable to be released later this year. The report will offer guidance to the Australian research community, private sector, and governments on opportunities for development of negative emissions in Australia.

Australia's research strengths and comparative advantages in negative emissions

Australia has strengths and comparative advantages that could make it an international leader in negative emissions. Roundtable participants identified that Australia has the following comparative advantages:

- world leading renewable energy potential and a wealth of critical minerals. GHG removal approaches can have high renewable energy demands.
- an abundance of land and ocean for testing and deployment of GHG removal and storage approaches, however further research is needed to understand the amount of available space.

Australia could also leverage the following strengths for development of negative emissions:

- a sophisticated legal and political system and institutional landscape with the capability to incentivise development and deployment and to manage trade-offs.
- experience sharing data publicly to attract investment, for example collecting and sharing pre-competitive geological information.
- world leading researchers with strong linkages with the international research community.

What is greenhouse gas removal?

Participants discussed the issue of terminology. The field has many overlapping terms that are used inconsistently. While a single clear solution was out of the scope of the roundtable, participants raised the need for a consistent terminological approach when engaging with stakeholders to enhance clarity and accelerate adoption.

Carbon dioxide removal (CDR) refers to the process of removing carbon dioxide from the atmosphere.[1] The term 'greenhouse gas removal' is a term more commonly used in the UK and Europe and includes other greenhouse gases such as methane.

Chair

Professor Chennupati Jagadish AC PresAA FTSE, Australian Academy of Science

Participants

Dr Pep Canadell, CSIRO and Global Carbon Project

Professor Deanna D'Alessandro, the University of Sydney

Dr Fay Farhang, University of Newcastle

Dr Andrew Feitz, Geoscience Australia

Professor Mark Howden, the Australian National University

Dr Andrew Lenton, CSIRO

Professor Catherine Lovelock FAA, University of Queensland

Professor Jan McDonald, University of Tasmania

Dr Gregory F. Metha, University of Adelaide

Laureate Professor Behdad Moghtaderi FIEAust, FAIE, University of Newcastle

Dr Keryn Paul, CSIRO

Professor Graeme Pearman AM FAA, University of Melbourne

Professor Peer Schenk, University of Queensland

Professor Mark Tjoelker, University of Western Sydney

Professor Stephen van Leeuwen, Curtin University

Professor Raphael Viscarra Rossel, Curtin University

Professor Lianzhou Wang, University of Queensland

References

1. IPCC. FAQ 4.2 What are Carbon Dioxide Removal and Negative Emissions? *FAQ Chapter 4 — Global Warming of 1.5 °C* https://www.ipcc.ch/sr15/faq/faq-chapter-4/ (2018) [Accessed 17 September 2022].