



CLIMATE ESSENTIALS PROFESSIONAL SHORT COURSE

CLIMATE CHANGE MITIGATION VIA REMOVAL OF ATMOSPHERIC GREENHOUSE GASES

Tuesday 16th - Thursday 18th March 2021, 9:00am - 12:30pm AEDT

> Delivery: Online in real-time

By signing the Paris Climate Agreement, Australia has committed to a global goal to hold average temperature increase to well below 2°C and to pursue efforts to keep warming below 1.5°C above pre-industrial levels. This will require deep and ongoing cuts in greenhouse gas emissions, reaching net zero emissions by 2050 or sooner. However, cutting our emissions will not be enough given the levels of greenhouse gases already in the atmosphere and ongoing emissions from some hard to ameliorate sources. The Intergovernmental Panel on Climate Change (IPCC) have assessed that meeting the 2°C target is only feasible if there is massive implementation of negative emissions technologies (NETs) that draw down greenhouse gases from the atmosphere and use or store them safely.

This short course has been designed for professionals who want to learn about the options Australia has for deploying NETs. It will cover why NETs are important, the technologies and practices available, as well as considerations for the implementation of NETs including communication and governance.

The course is run by the Australian National University and brings together leading researchers from across the University and industry experts.

Scope and content

The course will provide a summary of the latest climate science and why we need NETs, followed by an overview of the terminology and communication, sessions on options for carbon drawdown and utilisation and opportunities for industry development. The final session will consider the policy and governance landscape required for implementation of NETs. This will be tailored to provide direct contextual relevance to the decisions faced by Australian government departments, institutions and agencies.

Course details

- The course will be delivered online to facilitate participation by geographically diverse participants and COVID-19 considerations. The staggered structure is designed to maximise engagement and is based on advice from ANU experts in online course design.
- The course covers six broad topics over three mornings; two sessions per day, each session punctuated by discussion of the key points.
- Participation will be via the Zoom video conferencing tool, allowing direct interaction and discussion with lecturers and other course participants. The course will not be recorded – this is to facilitate open discussion under the Chatham House rule.
- Course timings are 9:00am – 12:30pm each day, Tuesday 16th – Thursday 18th March 2021.

Who should attend?

This course has been designed for professionals who want an overview of the latest information about NETs as a climate change mitigation option, what opportunities are available and what barriers need to be addressed. It is expected that participants will come from a range of different government departments as well as industry and non-government organisations, and that the diverse perspectives of participants will be useful for all attendees given that climate impacts are being felt across all sectors of our economy and society.

Important information

- To register, visit <https://climate.anu.edu.au/climate-essentials-climate-change-mitigation-removal-atmospheric-greenhouse-gases> and follow the registration details as described on the page.
- Registrations close on Friday, 12th March 2021.
- The course will take place subject to demand. Registrants will receive a full refund in the unlikely event that the course is cancelled.
- Group discounts are available for bulk registrations of three or more participants from the same organisation.
- Contact course convenor, Ruth O'Connor, via ruth.oconnor@anu.edu.au or 02 6125 4672 to find out more.
- Cost - \$1150 per person (including GST)

Program - Day 1, Tuesday 16 March

9:00am – Welcome and introduction

Professor Mark Howden and Dr Ruth O'Connor, ANU Climate Change Institute

Welcome to the course from Professor Mark Howden, Director of the ANU Climate Change Institute and Vice Chair of the Intergovernmental Panel on Climate Change (IPCC) Working Group II on Impacts, Adaptation and Vulnerability. Dr Ruth O'Connor will lead the group through an ice-breaker session.

9:30-10:55am Understanding climate change and why we need to draw down greenhouse gases

Professor Mark Howden, ANU Climate Change Institute

The climate is changing. Human-caused emissions of greenhouse gases have very likely caused global warming, which affects the climate on which our critical life-supporting systems depend. Climate change is characterised by global warming coupled with changed rainfall patterns, melting of ice sheets and glaciers, sea level rise, and an increase in extreme weather events amongst other things. Carbon budget approaches that relate cumulative carbon dioxide (CO₂) emissions to global mean temperature increase indicate the need to not just go to net-zero emissions but to draw down greenhouse gases from the atmosphere if we are to hold average temperature increase below 2°C. In this presentation, we will look at the past to learn about how the climate has changed, and then to the future for how negative emissions technologies and practices can impact our climate change trajectories.

At the completion of this lecture you will understand:

- the key drivers and underlying processes that are involved in climate change,
- the evidence for climate and related changes that particularly impact on systems in which Australia has specific interests,
- the concepts, calculation and implications of carbon budgets and
- the need for greenhouse gas drawdown as part of a suite of emission-reduction options.

10:55am – Break (20mins)

11:05-12:30pm Communicating effectively about negative emissions

Dr Bec Colvin, ANU Crawford School of Public Policy

While many solutions to the challenge of climate change are known, their implementation is often constrained not due to technical limitations, but instead due to the complexity of the social dimension. Human beings – who we are, our values, attitudes and beliefs, the norms we follow – are one of the most confounding aspects of climate change. While the concept of negative emissions is still in its infancy, there is evidence of nascent polarization, and a lack of nuance in discussion of individual technologies. Such polarisation among citizens and groups of policy-makers makes concerted action to slow the rate of climate change difficult. In this lecture, we explore key threads in the research on the social dimension of climate change, in particular the psychological basis of attitudes toward climate change. Based on this, we then explore how understanding this human dimension can inform climate change policy and practice, including strategies for effective communication and engagement.

At the completion of this lecture you will understand:

- the difference between key terms associated with NETs and the importance of terminology
- the links between values, beliefs, ideology and attitudes to climate change
- the risks of bundling negative emissions approaches together with other aspects of climate change issues and
- strategies and factors to consider when communicating about NETs and climate change.

End of Day 1

Program - Day 2, Wednesday 17 March

9:00am Welcome to Day 2

Dr Ruth O'Connor, Knowledge Exchange Specialist, ANU Climate Change Institute

Welcome to the second day of the short course.

9:05-10:35pm Options for action: Carbon capture in materials

Professor Penny King, ANU Research School of Earth Sciences

There are a wide range of options at various stages of development for capturing atmospheric carbon in materials, where it does not contribute to global warming. For example, mineralization processes where reactive minerals are combined, forming chemical bonds with CO₂ that store it in stable carbonate minerals. Currently, NETs seldom produce a valuable (saleable) product at scale to offset costs, but options that transform atmospheric CO₂ into valuable products such as building materials, fuels or chemical feedstocks are in development. Some examples include mineral carbonation that produces building materials, or catalysts that split CO₂ to produce basic compounds that can be fed into 3D printers to create anything that is currently made of plastic. In this lecture we will discuss how atmospheric greenhouse gases can be converted to materials and their potential for climate change mitigation.

At the completion of this lecture you will understand:

- the major options available for carbon capture in materials and
- the current state of application of these practices and the opportunities and challenges associated with scaling up.

10:35am - Break (20mins)

10:55-12:30pm Options for action: Enhancing natural processes (on land and sea)

Professor Justin Borevitz, ANU Research School of Biology

Professor Eelco Rohling, ANU Research School of Earth Sciences

Some of the oldest options for climate change mitigation via NETs such as reforestation involve enhancing natural biological and geochemical processes. We can increase carbon capture and decrease loss from the land cycle. This represents a tremendous opportunity to draw down carbon into biomass and soil storage to reverse global warming, while adapting to climate change so as to provide healthy food, ecosystems and livelihoods. The ocean covers over 70% of the Earth's surface, contains many times the amount of carbon in the atmosphere and terrestrial biosphere, and will be the predominant, largest long-term natural sink for anthropogenic CO₂. A range of methods exist that increase carbon drawdown into oceans such as fertilisation and carbon capture in algae, mangroves and sediments. In this lecture, we will discuss the latest advances in the development and application of NETs that enhance natural processes.

At the completion of this lecture you will understand:

- the major options available for enhancing natural processes to draw down and store carbon on the land and in oceans and
- the current state of application of these practices and the opportunities and challenges associated with scaling these up.

End of Day 2

Program - Day 3, Thursday 18 March

9:00am Welcome to Day 3

Dr Ruth O'Connor, Knowledge Exchange Specialist, ANU Climate Change Institute

Welcome to the third day of the short course.

9:05-10:35am Carbon Capture and Utilisation: Opportunities for Industry

Dr Célia Sapart, CO₂ Value Europe

Carbon Capture and Utilisation (CCU) transforms CO₂ captured from industry processes or directly from the atmosphere into valuable products such as building materials, fuels or chemical feedstocks. Recycling industrial CO₂ emissions which would otherwise be released into the atmosphere both creates new industrial growth opportunities and limits net greenhouse gas (GHG) emissions. In this lecture we explore how CCU is being promoted in Europe through legislation, policy and funding instruments and the types of projects underway as part of the emerging circular economy. We will also reflect on the opportunities available for CCU in Australia.

At the completion of this lecture you will understand:

- current developments in CCU research and application in Europe and the legislative, policy and investment drivers and
- opportunities for industry associated with CCU in Australia.

10:35am - Break (20mins)

10:55-12:30pm The policy and governance landscape for negative emissions technologies

Aaron Tang, ANU Fenner School of Environment & Society

The broad scale implementation of negative emissions technologies required to contribute meaningfully to climate change mitigation can be compared to humanity's shift from the horse to the car. However, few NETs have the well-established governance or regulatory frameworks necessary to ensure safety and their effective and efficient deployment. Social and political acceptance will also be essential if NETs are to play a significant role in mitigating climate change. In this lecture, we will look beyond technical considerations and discuss what is required for broad scale deployment of NETs and the role of governments (particularly in Australia) and governance in this transformations.

At the completion of this lecture you will understand:

- the role(s) of governments in the development and application of NETs,
- the political dimensions of negative emissions technologies and
- how to build social acceptance.

End of Day 3

Biographies (in alphabetical order)



Professor Justin Borevitz, ANU Research School of Biology

Justin Borevitz leads the Plant Genomics for Climate Adaption research group within the Centre of Excellence in Plant Energy Biology. His current work within the Centre is using Landscape Genomics to select the gene variants underlying adaptation to shifting climates and soils for restoration of global crops and woodlands. His group is also developing a landscape regeneration toolkit. Landscape regeneration is one way of capturing CO₂ by enhancing agriculture and natural systems to better capture sunlight and water for growing grasses and trees, and recycle nutrients.



Dr Bec Colvin, ANU Crawford School of Public Policy

Bec Colvin is a social scientist and Lecturer with the Resources, Environment & Development Group at the ANU Crawford School of Public Policy. Bec's research interest include how groups of people interact with each other - especially in settings of social and political conflict - with regard to climate and environmental issues. Much of her work has a focus on the dynamics of formalised processes for including citizens and stakeholders in decision-making.



Professor Mark Howden, ANU Climate Change Institute

Mark Howden is the Director of the Climate Change Institute at the Australian National University. Mark's work has focussed on how climate impacts on, and innovative adaptation options for, systems we value: agriculture and food security, the natural resource base, ecosystems and biodiversity, energy, water and urban systems. With over 30 years in the field and over 400 publications, Mark has been a major contributor to several of the Intergovernmental Panel on Climate Change (IPCC) Assessment Reports and is now a Vice Chair of IPCC Working Group 2.



Professor Penny King, ANU Research School of Earth Sciences

Penny King is a geochemist and leads a research group that examines surface and interior processes on planetary bodies. The group aims to understand the fundamental aspects of how materials in the solar system behave and how to identify them using remote and infrared techniques. Knowing how materials change under different conditions allows us to predict planetary environments (in the past and future) and to make better tools to explore active processes on the Earth's and beyond, including the effects of climate change. She is a Fellow of the American Geophysical Union, Fellow of the Mineralogical Society of America and Senior Fellow of Advance HE (Higher Education). Penny has also published more than 80 journal articles and book chapters and has edited two books.

Biographies (continued)



Dr Ruth O'Connor, ANU Climate Change Institute

Ruth O'Connor is the Knowledge Exchange Specialist with the Climate Change Institute (CCI) at the Australian National University. Ruth's role with the CCI is to facilitate the strengthening of links between climate change researchers and end users of the research. Ruth's interests include exploring mechanisms to bring together researcher and professional expertise to address complex societal issues and evaluation of those processes.



Professor Eelco Rohling, ANU Research School of Earth Sciences

Eelco Rohling is a Professor of ocean and climate change and ARC Laureate Fellow at the ANU Research School of Earth Sciences. He is a Fellow of the American Geophysical Union, and Fellow of the Royal Netherlands Academy of Arts and Science. He has published over 190 peer-reviewed publications, and two public science books.



Dr Célia Sapart, CO₂ Value Europe

Célia Sapart is a Swiss climate scientist, specialist in greenhouse gas emissions and historical climate reconstructions. After 13 years of academic climate research, including several long expeditions to polar regions and more than 20 scientific publications, she has now engaged at the front line of the climate action in becoming Climate Expert and Head of Communications at CO₂ Value Europe. Her role is to investigate the climate mitigation potential of CO₂ Capture and Utilisation (CCU) technologies and to develop communication strategies to raise awareness and acceptance on the CCU concept at all levels.



Aaron Tang, ANU Fenner School of Environment & Society

Aaron Tang is a PhD scholar examining international governance structures of negative emissions technologies. This involves looking at effective governance structures for other global issues, and determining their application to the topic area of negative emissions. Aaron's research also explores the current international environment regime complex and potential avenues for policy integration of negative emissions technologies.