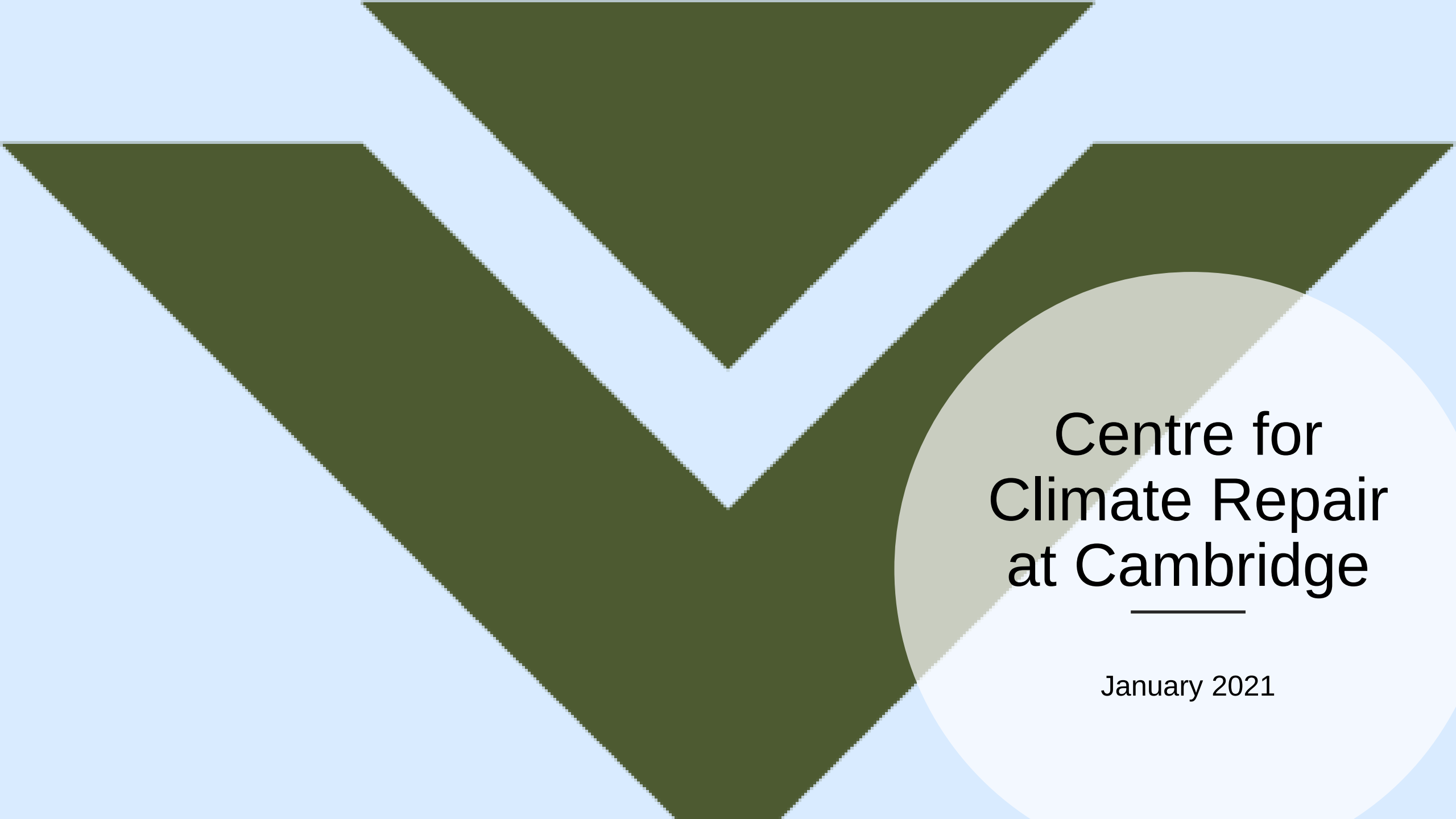




Centre for Climate Repair at Cambridge

January 2021

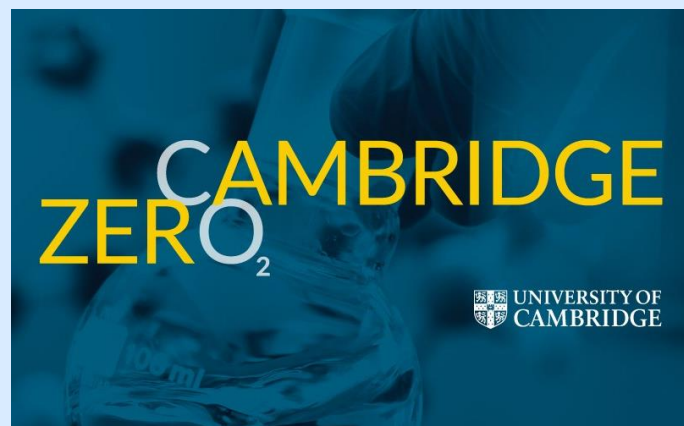


What is the problem?

The impacts of climate change pose a huge threat to economic growth, human health, livelihoods, biodiversity and food security.



The **lives of hundreds of millions of people are at stake**, with the prospect of mass migration at a scale never envisaged before.



The **Centre for Climate Repair at Cambridge (CCRC)** aims to provide a focal point for international experts on tackling carbon drawdown and climate repair. There are currently research groups around the world exploring specific methods, but no single approach is going to be sufficient. An integrated strategy which pulls together a portfolio of activities is required, and an objective dispassionate research and appraisal body is critical.

The Centre is one of Cambridge Zero's strategic priorities. **Cambridge Zero** is the University of Cambridge's ambitious new climate initiative which aims to harness the range of research and policy expertise within the university to develop solutions to the climate crisis.



What will the CCRC do to address the problem?

- CCRC will establish a consortium of other Centres for Climate Repair in partner universities across the world, providing key research and advice to governments on how climate repair can be achieved.
- CCRC will carry out ambitious multi-disciplinary research to develop strategies for aggressive climate repair.
- CCRC will collaborate with industry and provide advice to policy makers and governments on climate repair.

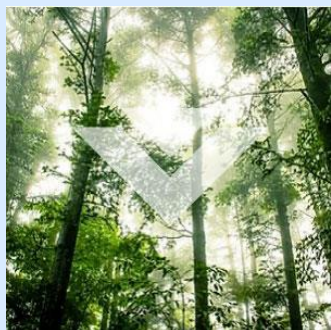


Three key objectives



Support deep and rapid emissions reduction

- CCRC will undertake multi-disciplinary research in specific areas in collaboration with colleagues from across the university and elucidate legal, economic, political, and ethical implications of various options for rapid global decarbonisation.
- **Working with Cambridge Zero we will help identify and recommend best near-term policies and actions to rapidly decrease emissions and achieve net-zero emissions, delivering on the UN Sustainable Development Goals.**



Greenhouse gas removal

- Current potential greenhouse gas removal (GGR) methods focus on removing CO₂, referred to as CDR methods. Little research into scaling and deploying a portfolio of these methods exists, nor does evidence of effectiveness against climate targets.
- **CCRC will undertake critical scientific and engineering research on GCR methods, appropriate governance and public engagement, in order to inform policy on the optimal portfolio of approaches.**



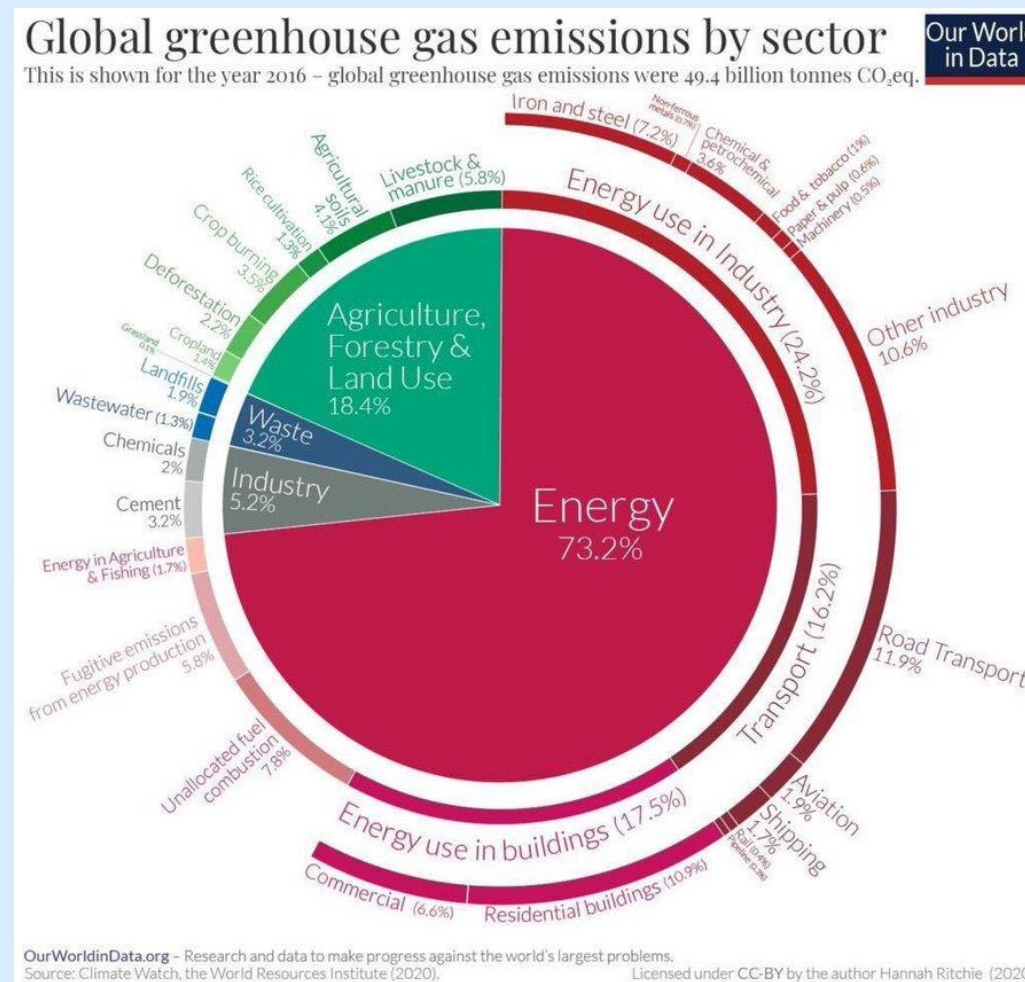
Researching solutions to restore damaged climate systems

- **CCRC recognises that targeted interventions may be required in order to restore certain climate systems, but there are many challenges which need to be addressed.**
- Investigations will focus on:
 1. Deployment safety and acceptability of potential experimentation
 2. Legal, economic, political, and ethical implications of even the experimentation of these approaches
 3. Assessment of the potential positive impact different approaches may provide



Support deep and rapid emissions reduction

- Tackling climate change requires a rapid reduction in greenhouse gas emissions.
- CCRC has expertise in energy use in buildings and will contribute to the work on emissions reduction by:
 - Considering the whole life cycle analysis of the built environment
 - Addressing the fundamental issues of thermal comfort in buildings whilst achieving zero emissions
 - Ensuring resilience for tackling pandemics is included in future buildings





Greenhouse gas removal

It is now widely accepted that rapid reductions in greenhouse gas emissions will not be sufficient to limit temperature rises to even 2°C. We have simply emitted too much CO₂ already. A global programme of greenhouse gas removal is required, but there is no clear strategy.

CCRC will undertake multi-disciplinary research on options for greenhouse gas removal which can be grouped into:

Nature-based solutions



- Forestation
- Wetland, peatland, and coastal habitat restoration
- Biochar
- Increased soil carbon

Hybrid approach



- Bioenergy with carbon capture and storage
- Timber buildings
- Ocean iron fertilization
- Ocean alkalinity

Engineering solutions



- Direct air with carbon capture and storage
- Carbonation



Greenhouse gas removal

The big scientific unknowns:

- Which approaches have enough scale-up potential to be worthwhile?
- What technological barriers need to be overcome to make these approaches viable?
- What experiments will be necessary?





Targeted interventions to restore damaged climate systems



Time is running out and even if we make significant progress with emissions reduction and greenhouse gas removal, we may be facing catastrophic and irreversible losses in the polar regions. We need to be prepared to potentially deploy targeted interventions to restore these zones and maintain them until greenhouse gas levels are sufficiently reduced.

There is no consensus on which approaches might work and our research will seek to establish which ones could potentially help.

- **Enhanced freezing:** wind-powered turbines to drive flows which expose more seawater to cold air in the winter
- **Marine cloud brightening (MCB):** increases the reflectivity of clouds, allowing them to reflect more sunlight
- **Stratospheric aerosol injection (SAI):** injection of reflective aerosol particles into the stratosphere to increase reflectivity, and reduce surface temperatures
- **Cirrus-cloud thinning:** the reduction of the lifetime and thickness of cirrus clouds which otherwise trap heat at the surface
- **Surface albedo modification:** involves increasing the albedo of buildings, crops and even ice to reflect more sunlight
- **Space mirrors:** deploying mirrors into orbit to reflect sunlight away from specific areas of the earth



Multi-disciplinary research

- The research programme is focused on innovating technology and determining which approaches we need to be deploying at scale to repair the climate.
- One of the key features of our approach will be to assess any potential downsides of different techniques and be up front about them.
- Through public engagement we will involve communities not just in decision-making, but in establishing the research methodologies in the first place.
- We will work with all the relevant stakeholders to devise experiments to test models, incorporating legal, economic, political, and ethical implications.





Meet the team



Our founder and chair, **Professor Sir David King** is the former Chief Scientific Advisor to the UK Government and served in the FCO as the UK's Climate envoy (2013-2017).



Dr Hugh Hunt is the current Co-Director of the CCRC as well as a Reader in Engineering at the Department of Engineering and a Fellow of Trinity College. His research interests lie in stratospheric aerosol injection and he was the co-principal investigator of the SPICE Project.



Dr Shaun Fitzgerald is the Director and is a Fellow of Girton College. In his previous position as Director of the Royal Institution, Shaun focused on engaging the public with science and engineering and harnessing his experience in this area will help work towards ensuring that technologies which are developed are those which are supported by the public.



Dr Emily Shuckburgh OBE is a climate scientist, mathematician and science communicator. She is Director of Cambridge Zero, the University of Cambridge's climate change initiative, and is a fellow of Darwin College, Cambridge. Her research interests include the dynamics of the atmosphere, oceans and climate and environmental data science.



Dr Eleanor Standen is a Senior Research Associate at the CCRC who brings her knowledge of business, government, and academia to the Centre.



Katie Parker is a Project Manager at the CCRC who brings her knowledge of sustainability consultancy, in-house sustainability leadership, management consultancy and marketing to the Centre



Why are we the right people?

Approach

CCRC brings an interdisciplinary, innovative approach to climate repair research, bringing experts together to make a difference and address the complex challenges that climate change presents. Multifaceted problems require multi-disciplinary research and action, and this approach is central to CCRC's way of working.

Expertise

Our current core team have decades of research experience in climate repair. This technical knowledge is complemented by expertise in public engagement and a track record of engaging with a variety of stakeholders including businesses, policy makers, and other researchers.

Existing and widening partnerships

The University of Cambridge boasts unparalleled breadth of expertise in a wide variety of disciplines relevant to climate repair and the Centre is well positioned to access and integrate these diverse perspectives within a unique programme that conducts research across disciplinary boundaries.



Wider Partnerships

The Centre recognises the global nature of climate change and this makes having international research partners critical to our success.

The coalition of Centres for Climate repair currently includes the University of Hawaii in Honolulu and Incheon University in South Korea. Other academic partnerships are currently in development with the University of Michigan, Stanford and MIT regarding future research projects.

CCRC also has connections nationally and internationally with charities, businesses, and finance institutions, all of whom are key stakeholders with relevant expertise on climate repair solutions and importantly the sustainability, financing, scaling up of new technologies, and public engagement. Examples include the World Wildlife Fund, UNEP-WMC, the Forestry Commission, Siemens, and leading investment houses.

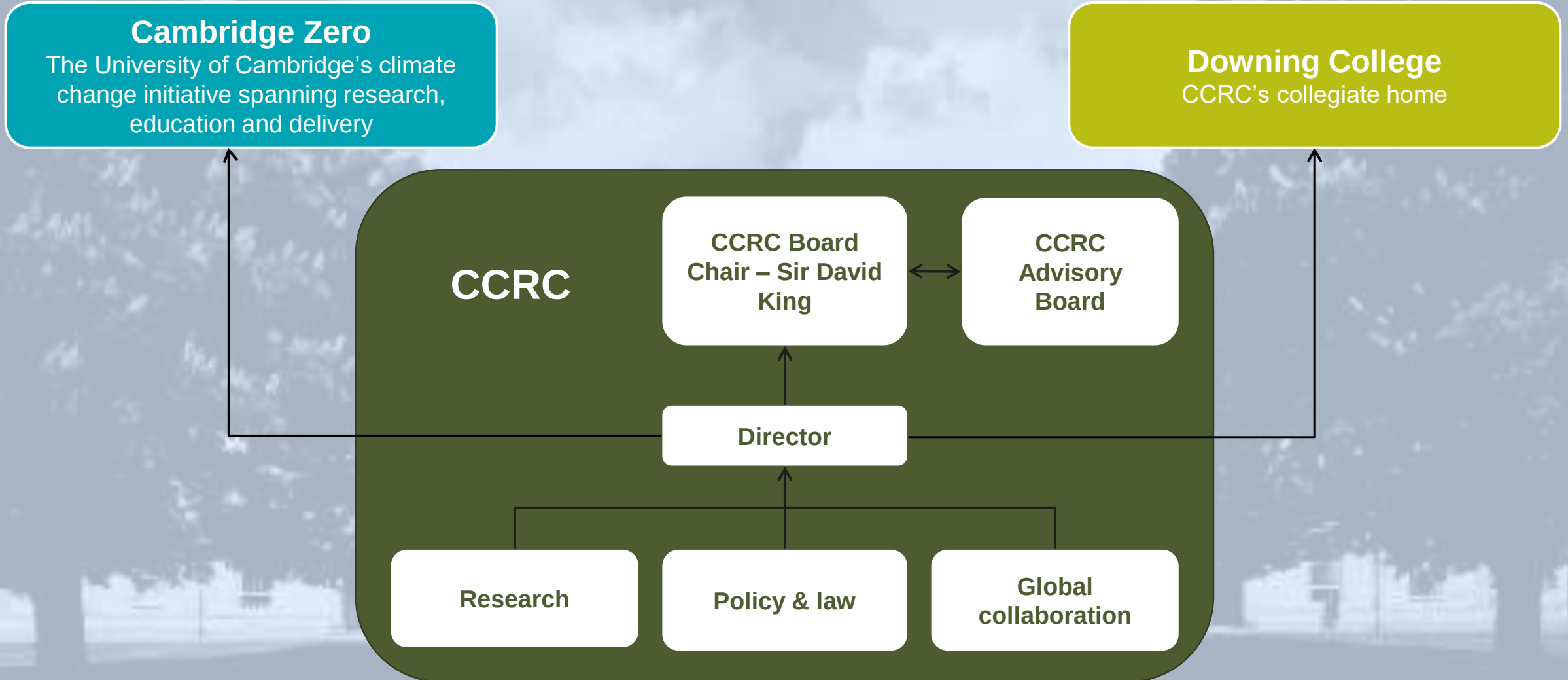


CCRC Partners





CCRC Governance





The Solution

Urgent action must be taken on climate change. Rapid emissions reductions are necessary but not sufficient – they must be accompanied by other measures if we are to limit temperature rise to 1.5°C, protect our most vulnerable ecosystems, and ensure a just and sustainable future for all. GGR and potentially targeted interventions will form a key part of these complementary actions.

CCRC is best positioned to be a leader in this field, providing a focal point for essential research in these areas in Cambridge, the UK, and internationally. We understand that aggressive mitigation is required but know that this will not be sufficient to limit the devastating impacts that climate change is having and will continue to have.

Our interdisciplinary approach, depth of expertise, location in Cambridge, and collaborative network of global leaders in the field will ensure pre-eminent research and its translation into actionable solutions. **Financial partners of the CCRC allow us to expeditiously achieve our objectives, as our opportunity to repair ongoing damage is rapidly disappearing.**



Why is funding needed?

- Current funding only provides resources for the first year.
- Additional funding is needed to build the core team and provide facilities.
- Funding for core staff and facilities enables CCRC to leverage additional funding via government grants and from myriad sources.
- Funding is needed for CCRC to host events bringing together academics, industry and policy makers/government.
- Funding will enable CCRC to undertake research projects on GGR and targeted interventions.



Funding priorities

- Academic and administrative staff
- Post-Doctoral researchers and PhD students
- A home for the Centre
- Conferences and engagement
- Experiments and fieldwork



Downing College Cambridge,
Current location of the Centre for Climate Repair



CCRC Annual Budget

Requirement	Annual Cost
Staff	~£1 million
Post-Doctoral Researchers and PhD Students	~£250,000
Building	~£100,000 (One off cost of £1-2 million for refurbishment)
Conferences and Engagement	~£250,000 - £500,000
Experiments	~£3 million
Total Annual Cost	£5-6 million



For further information, please contact:

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