Climate@Sussex

Climate change is a defining challenge for humanity in the 21st century. Unless the growth in emissions can be halted and reversed, the earth's climate will be significantly and irreversibly changed with profound effects on societies and ecosystems throughout the world. Understanding the responses of the complex Earth System to anthropogenic influences is vital to inform policy on adaptation and mitigation. Adapting to a changing climate is essential, but avoiding the worst-case outcomes while at the same time supporting growing populations and extending the benefits of industrial society worldwide, requires a transformation of society.

Confronting these challenges requires an understanding of their scientific, socio-economic, political, technological and policy dimensions, as well as the complex linkages between them. The Sussex Climate Change Network brings together world leading researchers from the University of Sussex and the Institute for Development Studies (IDS) in a multi-disciplinary programme of research and teaching to improve our understanding of how climate change is developing, the impacts on people and the implications for policy and action.

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Global Studies

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Climate research at Sussex is concentrated on the following four main themes:

Low carbon energy transitions

A central strand of our work is on the processes of technological and social innovation that will contribute to the transition to a more sustainable, low carbon energy future. We are particularly interested in how the long-term challenge of combatting climate change interacts with other energy policy objectives such as improving energy access and enhancing energy security.

While we start from the UK energy system, we also work on European issues and the developing world. Issues range from the local (e.g. community energy, city-scale sustainability) to the national (e.g. interaction of different national policy instruments) to the global (e.g. transfer of low carbon technologies to the developing world).

For example the *Centre on Innovation and Energy Demand* hosts a range of projects on the emergence, diffusion and impact of low energy innovations. The *Accelerating and Re-scaling Sustainability Transitions (ARTS)* project seeks to understand the role and impact of local transition initiatives in European city-regions (including Brighton and Hove as a case study) and examines ways to accelerate bottom-up approaches towards sustainable, low-carbon societies.

Meanwhile an innovative collaboration on *Low Carbon Innovation in China* compares government-led, high-tech 'indigenous innovation' with emergent, lower-tech approaches in the areas of agriculture, energy and mobility to explore the extent, nature and social implications of low-carbon transitions in China.

Improved energy efficiency is critical for the development of sustainable energy systems, but a stream of research on *Rebound Effects from Energy Efficiency* demonstrates how the unanticipated and unintended consequences of such improvements can frequently erode the anticipated energy savings.

Finally, the *Governance of Discontinuity in Technological Systems (DISGCO)* project seeks to develop a better understanding of the role of governance in the process of abandoning technological systems. The research focuses on the commitments by several countries worldwide to phase out nuclear power from its current major role in the energy sector with others ceasing previously planned expansion.

Politics of the low carbon economy

In debates about transitions to a low carbon economy, it is increasingly clear that as well as getting the prices right through market mechanisms and developing and promoting lower carbon technologies, we need to address the role of institutions, politics and policy processes.

One key project bringing together different strands of thinking in this area across the Sussex campus has been the work on *The Politics of Green Transformations*.[i] This draws together key insights from leading experts on the role of the state, finance and innovation as well as the politics of knowledge, coalition-building and the history of previous transformations in the economy and what this tells us about the prospects and politics of contemporary efforts to move to a low carbon economy.

Other work under this theme, supported by the Climate and Development Knowledge Network (CDKN), looks at the politics and political economy of low carbon energy in particular settings such as Kenya.[ii] It examines who gets access to different forms of energy and on whose terms. The projects have generated important insights into the extent to which and the ways in which 'climate compatible development' can be achieved in practice.

In research funded by the Economic and Social Research Council (ESRC) we have also looked at the global politics of the low carbon economy, including the growing importance of so-called 'rising powers' such as China, Brazil and India, in transforming the energy sectors of countries such as South Africa and Mozambique.[iii]

This work raises broader questions about the new forms of governance emerging to manage these transitions and to develop new transnational forms of governance that go beyond the UN climate negotiations. A project funded by the Leverhulme Trust resulted in a highly acclaimed book on this subject.[iv]

More fundamentally, there are major questions about the ability of a globalising, growth-dependent capitalist economy to mitigate climate change. These have been addressed by Sussex research on 'climate capitalism' which has explored how the global economy may need to be transformed to effectively address climate change.[v]

Climate resilient development

Climate change is already affecting the world's poorest and most vulnerable people, many of whom depend on agriculture for their livelihoods, but who often lack the robust systems and capacity needed to cope with climate change.

Efforts to integrate climate change adaptation into the development process must ensure that the most vulnerable groups are central to the climate change research and policy agenda. Colleagues across Sussex and IDS are carrying out research and policy analysis on climate change adaptation in some of the following areas:

Groundwater is a vital source of freshwater in Sub-Saharan Africa (SSA) and it is anticipated that rapid rural and urban development will place increasing demands on groundwater resources. The *GroFutures* project is developing the scientific evidence base, tools and participatory processes by which groundwater resources can be used sustainably for poverty alleviation in Sub-Saharan Africa. It is developing robust bio-geophysical and socio-economic assessment tools to forecast available groundwater resources under scenarios of changing climate, land-use and water demand, including expansion of arable land under irrigation.[vi]

Climate Science

Predicting future climate requires us to understand the processes (physical, chemical and biological) through which the various components of our Earth System interact with each other (the atmosphere, hydrosphere, biosphere, pedosphere and cryosphere).

Our research focusses on a number of key outstanding challenges of Earth System science including improving estimates of carbon fluxes in permafrost and forest ecosystems. The potential for further release of carbon stocks currently held in the permafrost region is a major concern and scientific uncertainty. The CYCLOPS consortium aims to understand the impacts of permafrost thaw and fire on ecosystem carbon stocks and fluxes and the feedbacks this might have on the climate.[vii]

Another area of work at Sussex seeks to understand the dust cycle and the associated direct and indirect climate impact and representation of dust aerosol processes in global and regional climate models. The Saharan climate system project 'Fennec' provided the most comprehensive observations ever made of dust aerosols and the state of the atmosphere in the centre of the Sahara during the extreme summer dust season.[viii]

Finally, under *The Future Climate for Africa (FCFA)* programme Sussex colleagues are advancing understanding of climate variability and change across sub-Saharan Africa and by improving the integration of science into longer-term decision making, leading to improved climate risk management and the protection of lives and livelihoods.[ix]

Sussex Climate research making a difference in the real world

Impacting on international climate technology policy: Research at Sussex on low carbon technology transfer and low carbon energy access in developing countries has had significant impacts on the policies, negotiating positions and funding strategies of a range of national and international governmental organisations, including: United Nations Framework Convention on Climate Change (UNFCCC), World Bank, OECD Environment Directorate, Asian Development Bank, African Development Bank and the Governments of the UK, India, Kenya and Chile. For example, UK government negotiators at the critical 2009 UN climate negotiations in Copenhagen used the research to inform the UK and EU negotiating position.

From 'Climate refugees' to climate adaptors: Research from Sussex's Department of Geography has contributed to a fundamental shift in public policy on climate induced human migration, from a perspective of migration as a security threat to one of an adaptation response. This has had an impact at the highest international policy level, most notably when the Cancun Adaptation Framework of the UNFCCC recognised for the first time at COP16 in 2010 that migration represents a potential adaptation strategy in the face of climate change, reflecting the novel and nuanced Sussex re-framing of the issue. This has influenced policy and practice of a wide number of international and national agencies including DFID, the Global Forum on Migration and Development, UNHCR, IOM and the European Commission.

Understanding Rebound Effects: Improved energy efficiency is critical for the development of sustainable energy systems. But does energy efficiency lead to a net reduction in energy demand? Analysts and policymakers tend to ignore these so-called 'rebound effects', but research at SPRU has shown they could be highly significant. This work is repeatedly cited in the latest report from Working Group 3 of the Intergovernmental Panel on Climate Change (IPCC) and has shaped several of the conclusions. The results of this work have informed policy guidance from the UK Department of Energy and Climate Change (Valuation of energy use in greenhouse gas emissions for appraisal and evaluation, 2010) and the UK Parliamentary Office of Science and Technology.

Teaching

As well as conducting world-leading research the University of Sussex is also home to a number of postgraduate courses in climate change, development and sustainability.[x]

These unique, multi-disciplinary programmes are taught by staff from across the Sussex Climate Change Network. The programmes provide state-of-the-art training for climate change professionals in the complex scientific, socio-economic, technological and institutional issues of climate change mitigation and adaptation and include:

- MSc Climate change and Development
- MSc Climate Change and Policy
- MSc Energy Policy for Sustainability
- MA Environment, Development and Policy

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Sussex Energy Group blog
http://blogs.sussex.ac.uk/sussexenergygroup/category/posts/

Sussex Climate Change Network
www.sussex.ac.uk/climatechange/

Institute of Development Studies
www.ids.ac.uk/research

Steps
http://steps-centre.org/

Sussex Sustainability Research Centre (SSRP)
www.sussex.ac.uk/ssrp

Climate Science and Society Research group in Geography
www.sussex.ac.uk/geography/research/climateresearch

[i] http://steps-centre.org/publication/green-transformations/

[ii] http://steps-centre.org/publication/politicaleconomyenergy/ & http://steps-centre.org/publication/energyaccess/?referralDomain=working-paper

[iii] http://steps-centre.org/project/rising-powers/

[iv] http://www.cambridge.org/gb/academic/subjects/earth-and-environmental-science/environmental-policy-economics-and-law/transnational-climate-change-governance

[v] http://www.cambridge.org/gb/academic/subjects/earth-and-environmental-science/environmental-policy-economics-and-law/climate-capitalism-global-warming-and-transformation-global-economy?format=PB

[vi] http://upgro.org/consortium/grofutures2/

[vii] http://www.sussex.ac.uk/geography/research/climateresearch/global_carbon_cycle

[viii] Find out more about research at Sussex on Atmospheric aerosols http://www.sussex.ac.uk/geography/research/climateresearch/atmospheric_aerosols

[ix] http://futureclimateafrica.org/

[x] http://www.sussex.ac.uk/study/pg/2015/taught