

Living With Environmental Change

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A Cooler Day at the Office

The 1960s were a cultural turning point – the decade that defined ‘cool’. But in terms of the built environment, their legacy poses some real challenges. “Cool” needs redefining literally and Cornwall Council’s offices in Camborne are a case in point. As with many buildings of the same vintage, they won’t be able to maintain staff comfort (and therefore productivity) in the rising summer temperatures and fluctuating extremes expected as the UK’s climate changes.

But a £4 million refurbishment is tackling the problem, using local climate projections provided by PROMETHEUS, an Exeter University project that’s part of the LWEC-accredited Adaptation and Resilience to a Changing Climate programme. The Technology Strategy Board’s Design for Future Climate competition has also provided funding.

Modifications to this four-storey building will reduce solar gain, promote cooling and increase ventilation. Changes to the way staff use the building will also help to keep it cool while reducing energy use.

This would not be possible without significant innovation in building design and refurbishment planning tools which take account of the latest knowledge about the future. Success in Camborne can be replicated elsewhere.

“Our existing building stock needs to adapt to climate change and reducing our corporate carbon footprint is paramount,” says Peter Woodford, Group Architect at Cornwall Council. *“We’re also applying these principles to our upcoming refurbishment of Truro’s New County Hall.”*

A photograph of a modern office interior. In the center, there is a white silhouette of a person standing. The office has white desks, black chairs, and large windows in the background. A red chair is visible on the left. The floor is dark grey with a patterned carpet.

**Practical steps
to adapt council
buildings in Cornwall
to projected climate
change.**

Adaptation and Resilience to a Changing Climate

What is the programme doing?

The Adaptation and Resilience to a Changing Climate (ARCC) programme brings together a range of research projects which look at the impacts of climate change and possible adaptation options in the built environment and its infrastructure including water resources, transport systems, telecommunications, energy and waste.

- Enabling the design of urban systems that are more resilient to climate change.
- Providing evidence for decision makers and policy makers.
- Increasing the efficient and focussed dissemination of research outputs.
- Improving the ability of researchers to engage potential users.

What tools are available?

- A prototype decision-support tool has been developed to identify future heat hazards at the building, neighbourhood and city scale for use by local authorities and others to aid long term design and planning in urban areas.
- New sets of probabilistic weather years have been developed for 2030, 2050 and 2080 for various locations across the UK based on the UKCP09 projections. These will enable building designers and engineers to study the thermal performance of buildings under likely future conditions.
- New tools to model and interpret the impact of local climate in urban areas (in particular London) and to evaluate the impacts of temperature on energy use, comfort and health in buildings. A decision support framework to aid decision makers and planners is being developed.

How will the knowledge and outputs be used?

Many of the projects are providing sector-specific knowledge on practical strategies to enable a wide range of users to meet the challenges presented by climate change. For example, to help:

- Design robust water supply infrastructure systems at regional and local levels.
- Ensure health and social care systems supporting older people will be resilient to climate change.
- Develop feasible adaptation scenarios to improve resilience in both cities and suburbs.
- Improve the adaptive capacity of local communities to the impacts of extreme weather events.

Programme Facts And Figures

Total investment: £12 million.

Contact arcc@ukcip.org.uk

www.ukcip-arcc.org.uk



Rapid Diagnosis could transform Healthcare

Novel handheld devices that detect infectious diseases with amazing speed and accuracy could start entering clinical use within three years, saving lives and slashing healthcare costs. The Detection and Identification of Infectious Agents Innovation Platform, accredited by Living With Environmental Change, is stimulating the development of these devices, which will deliver rapid diagnosis of serious human and animal illnesses ranging from hospital 'superbugs' to foot-and-mouth disease.

Early diagnosis is critical to treating infectious diseases effectively and preventing their spread. Diagnostics can also be used to reduce the inappropriate use of antibiotics and identify a treatment regime to which an infection is likely to respond. Such devices could enable early interventions by doctors and negate the need for patients to return to a hospital or clinic for their test results and any treatment.

"As these devices become integrated into our healthcare system, they could help to minimise the impact of future epidemics such as swine flu", says the Platform's Lead Specialist, Dr Penny Wilson of the Technology Strategy Board.

The Platform is encouraging UK businesses to take the lead both in developing these revolutionary devices and in securing uptake across the healthcare sector. To date, 34 R&D projects have been funded with a total investment of £10 million (including co-funding from the Department of Health, the Engineering and Physical Sciences Research Council and the Home Office). And with clear potential for the devices to find a worldwide market, success could not only tackle disease but also improve the health of the UK economy.

Developing handheld devices to detect infectious diseases fast.

Detection and Identification of Infectious Agents Innovation Platform

Innovation Platforms are designed to address major society and public policy challenges and focus where a government department is taking specific action through policy, regulation, procurement or financial measures to tackle the problem.

The Detection and Identification of Infectious Agents Innovation Platform will fund research and development to produce new rapid diagnostic tests and point of care devices for the detection and identification of infectious agents in both humans and animals.

Expected outcomes

- Reduction in the number of deaths and amount of illness caused by infectious agents.
- Fundamental change in the ability of UK business to provide solutions to detection.
- Boost in UK economic performance.
- Higher quality public services.
- Use of the technology developed across the world.

Who would use the outputs?

Policy makers: The range of diseases and areas chosen were prioritised by the Department of Health and Defra.

Industry: Success for this Innovation Platform would be the development by UK industry of diagnostic tests including point of care devices for the rapid and effective detection and identification of infectious agents to be used in the UK and globally.

The devices should be rapid, sensitive and specific, cheap, easy to use, minimally invasive, compact, stable and compatible with existing systems.

Programme Facts And Figures

Total investment: £55 million.



UK Economic Growth depends on **the** Health of our Ecosystems

Future economic growth will be undermined unless we understand the full value of the natural world on which our wealth, health and well-being depend.

This is one of the messages from the UK's first National Ecosystem Assessment report, published in June 2011.

The report highlights the considerable economic value of our environment and also shows the environment's very real benefits to health, community and wellbeing - things that are beyond price.

Until now, the many services and benefits provided by natural processes have been ignored or degraded because their economic, social and even spiritual value falls outside traditional economics. The National Ecosystem Assessment develops new ways of assessing and valuing so-called ecosystem services so that we can make our current economic and business models more robust.

"Our natural environment provides us with services such as clean water, food, materials from timber to aggregates, biodiversity, recreation, flood defence, carbon storage, green spaces in cities" says economist, Ian Bateman, one of over 500 experts from many different fields of knowledge who have contributed to this undertaking. *"It's a pretty long and important list. Most of the goods and services don't have a financial, market value – that's why they get ignored or over-used. But you can put values on the services the natural environment provides".*



National Ecosystem Assessment

The National Ecosystem Assessment is an independent and peer reviewed assessment of the state and value of the UK's natural environment and the services it has provided over the past 60 years and what may drive change in the future.

- **Ecosystems** are dynamic complexes of plant, animal and microorganism communities and their non-living environment interacting as a unit.
- **Ecosystem services** are the products such as goods and services that come out of the ecosystem. These can be food, water purification or spiritual experience. The combination of these goods and services contributes to human well being in terms of health, wealth and happiness.
- **An ecosystems approach** is a way of considering and valuing natural resources in decision making.

What tools are available?

A conceptual framework links drivers of change to changes in biodiversity and ecosystem goods and services, and human wellbeing. This framework can be used to assess how drivers of change have affected or will affect the main broad habitats (ecosystems) in the UK and their role in providing ecosystem services that benefit people.

How will the outputs be used?

Policy makers:

- High level policy makers will have outline policy options to secure the continued delivery of the UK's ecosystem services.
- Policy makers will have the evidence base needed to strengthen decision making and ensure effective management in the future.
- The NEA feeds into the Environment White Paper.

Programme Facts And Figures

Total investment: £1.3 million.



Algae Energy Alternatives

Algae seem to have captured the imagination of a range of businesses from water companies to well-known high street retailers who are looking for new ways to generate energy. Policy-makers are also considering whether this kind of plant life has a role in tomorrow's energy landscape. To further the debate, the Living With Environmental Change-accredited Algal Bioenergy Special Interest Group aims to help pinpoint and exploit algae's potential as a green energy source.

This new Natural Environment Research Council and Technology Strategy Board initiative is focusing on single-celled 'microalgae', which can be converted into biodiesel, and 'macroalgae' (i.e. seaweed), which can be turned into biogas, bioethanol and other clean fuels.

"A lot of high-quality research has already been undertaken in the UK," says Dr Michele Stanley, the Group's Director. "But now we want to bring the right people together, from academia and industry, to forge collaborations that can make algal bioenergy a reality."

A core objective is to understand the full environmental implications of harnessing this prolific energy source. Cultivating algae could deliver important benefits, from boosting biodiversity to effective absorption of atmospheric carbon dioxide. But there could be downsides – for instance, the possible effects on seafloor communities when an area becomes shaded by a seaweed farm.

A key aim of the Group is to catalyse science relevant to the commercial exploitation of algal bioenergy. *"We want to raise awareness and generate knowledge about a potential energy solution that could help deliver a sea change in the way we meet our energy needs,"* says Dr Stanley.

A special interest group explores how seaweed and other algae can become commercial sources of green power.



Algal Bioenergy Network

The Algal Bioenergy Special Interest Group is investigating the opportunities and risks to the quality of freshwater and marine environments of using algal biomass as a source of renewable energy. The programme funds a Director, two research fellows and a knowledge exchange fellow.

The purpose of the group is to rapidly scope the environmental science potential in the area of algal bioenergy, and to build the research networks and secure the key partnerships needed to facilitate this.

Research questions include:

- Can marine biomass be harvested from wild or cultivated algae resources?
- Can land-based microalgae technology be transferred to freshwater and marine environments?
- What are the positive and negative impacts of scaling-up production on the wider environment?
- What are the potential problems of large-scale cultures or algal farming and harvesting on ecosystems?

Some ideas that could be developed in the future include:

- Identifying the possible feed stocks and conversion technologies that may emerge over the next 10 years for deployment, including evaluation of micro versus macroalgae and freshwater versus marine.
- Assessing the environmental implications of imports of algal resources for bioenergy use.
- Predicting the environmental consequences of the deployment of algae in the UK for bioenergy and other value-added co-products.

Expected outputs

The group will develop an evidence base for decisions on growing algae for bioenergy. This would include

- Best algal feed stocks for the UK.
- Most appropriate locations and environmental implications of macroalgal production.
- Modelling the implications of scaling up microalgae production on the environment.

This will enable early evaluation of the environmental and economic impact of algal energy through development of a sustainability framework using related work developed for terrestrial bioenergy.

Programme Facts And Figures

Total investment: £0.6 million.



Snakes and Ladders to the Rescue

Using a game to help communities recover more quickly from serious flooding.

Recovering from a flooded home can be a nightmare. But real-life experiences have inspired the Lancaster Environment Centre at Lancaster University to develop an imaginative game that could make the process less drawn-out and distressing in future. The aim is to give emergency planners and insurers, for example, a clearer picture of the challenges and traumas involved in flood recovery and so enable them to meet people's needs more effectively.

The concept emerged from an LWEC-accredited study tracking the experiences of householders in Hull affected by flooding in 2007. *"One participant mentioned that coping with the aftermath is like a game of snakes and ladders,"* says Dr Beccy Whittle. *"We thought this would be a brilliant way of raising awareness of what flood recovery actually entails."*

This work was developed under the Living With Environmental Change-accredited Flood, Vulnerability and Urban Resilience Study.



Flood, vulnerability and urban resilience

Flood, vulnerability and urban resilience: a real-time study of local recovery following the floods of June 2007 in Hull.

The study ran for two years between 2007 and 2009. Using diaries, interviews and group discussions, the study followed the recovery experiences of people across Hull after the floods of June 2007 which affected over 8,600 households across the city.

Findings

The research shows flood recovery to be a long and difficult process with no clear beginning or end. Far from being an incremental, linear process, respondents' recovery is punctuated by 'highs' and 'lows' which are closely tied to other pressures and life events. Recovery is not complete when people move 'back home', as aspects of daily life are shown to have fundamentally changed – both for better and for worse.

What tools are available?

- A unique archive of data has been established to promote future learning and allow secondary analysis. The data archive will be made available through the Economic and Social Data Service (<http://www.esds.ac.uk>).
- A 'Flood Snakes and Ladders' tool is currently being developed. This is an interactive flood simulation recovery tool which was developed using material from the diaries. The tool can be used to train policy makers and emergency planners and can be applied to other emergency situations, as well as flooding. The tool will also be of interest to insurance companies and builders who are involved in flood recovery.

How are the outputs being used?

Policy makers: The project has contributed to a number of national government Acts, reviews and consultations, such as the Flood and Water Management Act 2010; the Pitt Review into the floods of Summer 2007; the national flood emergency framework & Environment Agency internal policy on flood recovery. The researchers make recommendations on national policy documents to the Cabinet Office community resilience programme and the researchers also met with a visitor from the USA as part of the UK Civil Contingencies Secretariat Programme for Community Resilience.

Business: The researchers have held meetings with senior insurance claims people to discuss the findings, hosted by the Association of British Insurers & presented at the British Damage Management Association annual convention - this involves companies involved in drying out and restoration of flooded homes.

Programme Facts And Figures

Total investment: £150 thousand.



Metal Guru

Carbon-cutting technologies such as wind turbines and electric vehicles rely on a ready supply of rare-earth metals. Government and business therefore need to know exactly how much metal the UK uses and, just as importantly, whether supplies are secure. Thanks to the Living With Environmental Change-accredited Minerals and Waste programme, managed by the British Geological Survey, policy-makers at both UK and EU level get the critical information they need and this can be shared with business.

The British Geological Survey has gathered statistics on global metal production for nearly a century and the Minerals and Waste programme harnesses links forged with around 170 contacts in ministries and other organisations worldwide. Data collected is used to identify global trading patterns, material flows and long-term trends, and the quantities and sources of metals used in the UK and EU.

With the EU 100% dependent on external supplies of cobalt and zirconium, for example, this is essential information. Even a mobile phone contains 30 different metallic elements.

Moreover, with rising living standards in China and elsewhere boosting demand, pinpointing potential risks and vulnerabilities affecting the sourcing of metals is increasingly vital.

"Our advice helps shape important activities like the EU Raw Materials Initiative," says Programme Manager Andrew Bloodworth. *"In areas like resource efficiency and the environmental impact of metals procurement, we provide the solid platform of fact on which effective policies and strategies can be built."*

Providing knowledge of global trade, sources, flows and trends in metal demand and supply in the UK and EU.

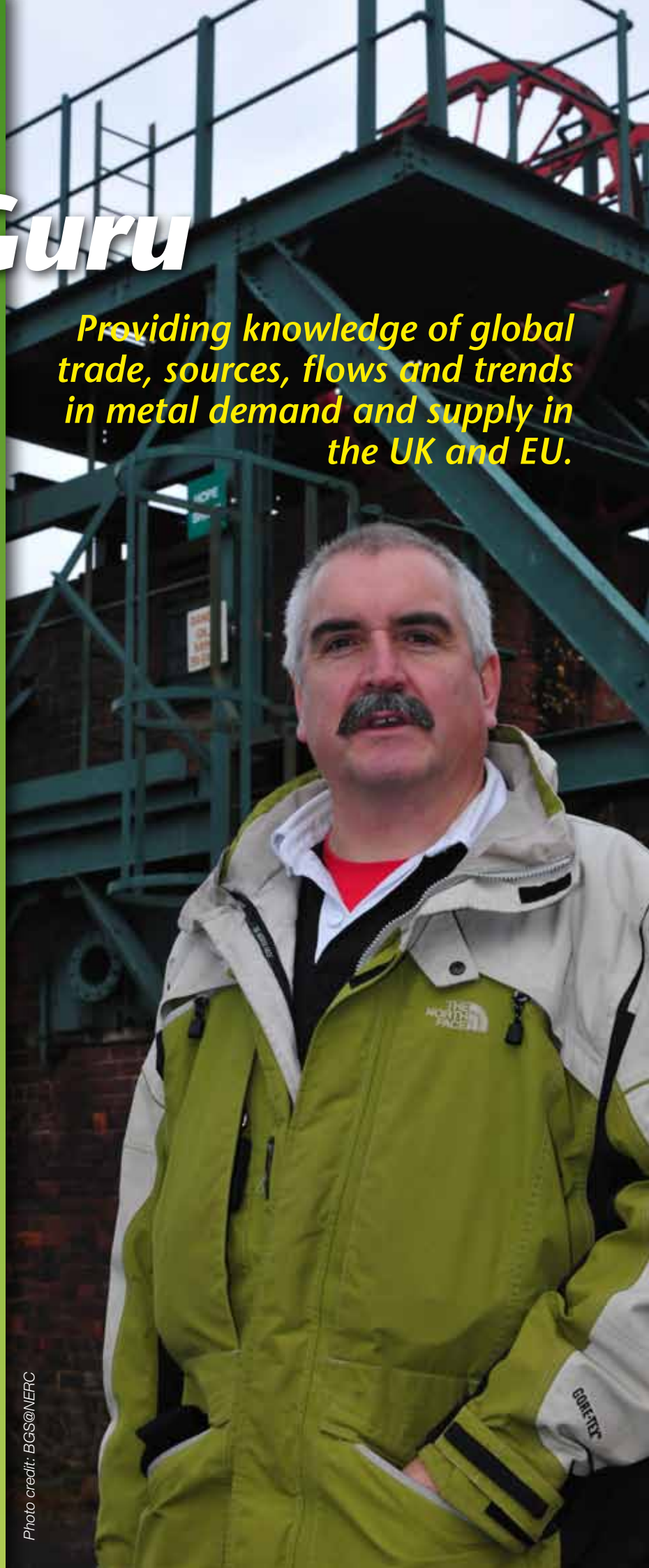


Photo credit: BGS@NERC

Minerals and Waste

The Minerals and Waste programme is run by the British Geological Survey, in partnership with others, in order to address the need for the UK to secure a sustainable supply of minerals and energy, in the face of the population increase and environmental change. It has five main areas:

1. Raw materials for new technologies: Investigate the sources of raw materials for environmental technologies such as electric vehicles and wind turbines.
2. UK building stones: Investigate the carbon cost of domestically-produced materials for the construction industry.
3. Global monitoring and analysis of mineral production: This will inform European Union and UK policy on security of supply in the face of population growth and environmental change. The British Geological Survey currently exchanges information and collaborates with 170 geological surveys, mine ministries and regulators across the globe to collate and verify these data.
4. Long-term impact of mine waste on ecosystems and human health: This will provide data and methods to underpin the implementation of the Mine Waste Directive in the UK.
5. Safe disposal of radioactive waste and safe transport of radioactive elements: Advice will be provided to the Nuclear Decommissioning Agency, the Department of Energy and Climate Change and the European Commission and will also assist in the development of the new phase of nuclear power plants, that will play a major part in helping the UK to meet its carbon reduction targets.

Expected outputs

- Better national policy on planning for secure and sustainable mineral supply.
- Reduced operational and regulatory costs and improved environmental performance of mineral extraction.
- New guidance for England on safeguarding of minerals. This places a non-monetary valuation on mineral resources in the ground which is intended to ensure that their value to future generations is considered when making decisions about built development.
- Advice to the European Commission on raw materials, feeding into possible new policy on identification and mitigation of problems related to security of supply of critical raw materials - particularly those for environmental technologies in a world where competition for such resources is growing rapidly such as rare earth elements and metals such as gallium, indium and cobalt.
- Ability to rapidly simulate greenhouse gas implications of national and regional spatial policy decisions regarding supply of aggregate minerals to UK economy.
- Enhanced energy security and reduced greenhouse gases for the UK through improved long-term radioactive waste management policies.
- Better radioactive waste repository design and improved safety case.

Programme Facts And Figures

Total investment: £1.6 million.

www.bgs.ac.uk/mineralsuk



Arriving at the Low-Carbon City

Half of the world's population lives in cities. So what can be done to reduce the colossal quantity of carbon emissions they produce? As part of a consortium funded by the Department of Energy and Climate Change, the Living With Environmental Change-accredited Centre for Climate Change Economics and Policy aims to explore the economic potential for low-carbon cities – and a pilot study in the Leeds City Region is already under way. *"We're confident the study will highlight practical measures that will enable us to take significant steps forward in a cost-effective way"*, says Melanie Taylor of the Leeds City Region Secretariat.

By pinpointing least-cost carbon-cutting measures, the consortium is generating results applicable to cities in every corner of the globe. *"It's become clear that a big chunk of emissions can be eliminated by simple demand-side energy efficiency measures with a payback of two or three years,"* says Professor Andy Gouldson, the Centre's Director. *"But this is likely to depend on innovative policies and new forms of carbon finance."*

Hosted by the University of Leeds and the London School of Economics and Political Science, the Centre is at the forefront of the consortium's work, which is evaluating literally thousands of low-carbon options, ranking them by cost and carbon-cutting effectiveness, and producing detailed guidance for policy makers and investors. *"This data is absolutely crucial,"* Professor Gouldson emphasises. *"We believe it could make the difference between cities deciding to commit to de-carbonisation or failing to tackle climate change."*

A high-angle, nighttime photograph of a dense urban skyline. Numerous skyscrapers and buildings are illuminated with warm yellow and white lights, creating a vibrant, glowing effect against the dark sky. The perspective is from a high vantage point, looking down and across the city.

Innovation in cities to pin-point low cost carbon-cutting.

The Centre for Climate Change Economics and Policy

Hosted jointly by the University of Leeds and the London School of Economics and Political Science, and chaired by Lord Nicholas Stern, the Centre for Climate Change Economics and Policy brings together some of the world's leading researchers on climate change economics and policy, from many different disciplines.

Background

Human-induced climate change is occurring and could impose enormous costs on economies and societies if we persist with 'business as usual'. This is the consensus view of climate scientists and is increasingly accepted by climate-change economists. It is much less certain, however, that our economic, social and political systems can respond to the challenge.

Objectives

- Advance climate change policy and increase the capacity of public and private decision makers to respond to one of the most critical challenges facing the world today.
- Support a 'new global deal' on climate change, through a formal state agreement and through a wider set of actions worldwide, by improving both the evidence base and the tools and implementation strategies available to decision makers.
- Undertake an ambitious, innovative and interdisciplinary programme of research, firmly grounded in theory but with practical applications, linking science and social science and combining quantitative and qualitative approaches.

Research areas

- Developing climate science and economics.
- Climate change governance for a new global deal.
- Adaptation to climate change and human development.
- Governments, markets and climate change mitigation.
- The Munich Re Programme - evaluating the economics of climate risks and opportunities in the insurance sector.

Programme Facts And Figures

Total investment: £4.7million.

LWEC - an innovative partnership to ensure that decision makers in government, business and society have the knowledge, foresight and tools to mitigate, adapt to and benefit from environmental change.

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www.lwec.org.uk

