

International Policy



Energy



Adaptation



International Development



Coasts



Cities



Integrated Modelling



Research Strategy 2006-2009



“No comparable programme in its initial years has come further, faster or produced more exciting results than the Tyndall Centre” wrote the international panel of leading scientists and business leaders who appraised the first phase of the Tyndall Centre. Building on the great success of the existing Tyndall Centre, this research strategy summarises the next three years of our operation from 2006 to 2009.

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Our objective is to further enhance our expertise and functioning to continue to develop sustainable responses to climate change and understand and transfer this knowledge into policy and practical action. Over the next three years we will continue to bring together traditionally separate academic disciplines and network them together into this single virtual organization, the Tyndall Centre for Climate Change Research.

Our strategy builds upon our previous work on integrated assessment, energy, adaptation, and coasts and add three new programmes exploring international policy, international development and cities. We give greater focus to research deliverables produced in collaboration with the actual users of our research.

I believe that the ultimate beneficiaries of this Tyndall Centre research programme are the citizens of the UK, and of all countries, whose experience of climate change in the years ahead will introduce new risks and challenges over the next 50 years and beyond. This strategy demonstrates our commitment to researching sustainable responses to climate change.

Mike Hulme
May 2006

Further Sustainable Responses to Climate Change

While Phase 1 of the Tyndall enterprise (2000-2005) has demonstrated the potential of our novel approach to interdisciplinary climate change research, Phase 2 (2006-2009) has to bring it to full fruition. This has to be achieved whilst continuing both to shape and to respond to the changing international and domestic scientific and policy agenda surrounding climate change. By generating insights and delivering outcomes of the highest possible quality and relevance, the Tyndall Centre has and will continue to make a real difference to these evolving scientific and policy agendas during a crucial period of time.

In this spirit, the Centre reconfirms its vision statement: “The Tyndall Centre is the UK network of excellence for generating sustainable responses to climate change, based on world-class interdisciplinary analysis and innovative forms of stakeholder dialogue”

In support of this vision, the Centre’s three core objectives are:

- to seek, evaluate and facilitate sustainable responses to climate change that will minimize its adverse effects and stimulate policy for the transition to a more benign energy and mobility regime;
- to develop, demonstrate and apply new methodologies for integrating climate change related knowledge;
- to promote informed and effective dialogue across society about the options to manage our future climate.

The Tyndall Centre is unique in the UK in undertaking interdisciplinary research in support of sustainable responses to climate change, not only by covering the whole spectrum of geographical, time and human scales, but also by linking research efforts across disciplines in an integrated way.

We have carefully designed our new research based on a clear set of priorities shaped by a 12 month period of consultation and negotiation with stakeholder communities

and funders. These priorities are: determined by a sense of urgency to investigate crucial emerging issues for public policy, efficiency to exploit our own human resources and intellectual capital, novelty to address the strategic research priorities of our primary sponsors, and value-added to join efforts with other research capacities, both in the UK and abroad.

Over the next three years we will help to provide specific answers to well defined questions that can be grouped under seven broad topics. Our research on international policy, energy, and adaptation will help us all to prepare now for a sustainable future. Research on international development, coasts, and cities will help the most vulnerable communities and assets respond to the challenges imposed by climate change. Our integrated modelling will deliver and deploy an analytical tool, spanning climate and human systems, which will allow quantitative exploration of policy questions.

The Tyndall Centre will be truly useful.



The structure of the Tyndall Centre

Informing international climate policy

How can international action on climate change be effectively developed after 2012?

summary

International negotiations have started to shape plans for a new global climate change strategy after the first reporting period of the Kyoto Protocol ends in 2012. Concurrently, the UK and EU are devising new strategies to deliver a decarbonised and resilient society. Central to the nature and urgency of current and future policies is our understanding of climate risks and our ability to: link climate models to impacts; attribute observed changes to anthropogenic emissions; and examine the role of emerging climate strategies in producing significant emissions reductions to avoid dangerous climate change.

Although industrialised countries carry the burden of the majority of emissions reductions, action on climate change is increasingly driven by non-state actors such as local and regional governments, corporations and organisations, and by the developing world, yet these initiatives are weakly coordinated and their collective impact poorly understood.

Our research is responding to these challenges by focusing on the characterisation and communication of uncertainty and attribution in climate risks and impacts, and the opportunities and barriers for non nation-state actors and developing countries to produce emission reductions. It is strongly linked with the Tyndall Community Integrated Assessment System (CIAS) and Tyndall work on International Development. We listen carefully to national, European and international stakeholders, government negotiators, and political scientists.

tasks

Responding to policy demands for improved information at local and regional levels on impacts, attribution and uncertainty

Action on mitigation and adaptation is partly dependent on our ability to characterise climate risks, including uncertainties, to link them to impacts and adaptation, and to attribute the risks to emissions in ways that are meaningful for regional and local decision makers. Using a variety of tools including climateprediction.net, we are examining the representation and use of uncertainty to design policy at global and local scales and how the impacts of extreme weather might be attributed to the human role in climate change.

We are testing the use of probabilistic climate information in decisions by linking climate model outputs to impacts on water resources in the UK (in collaboration with the Environment Agency), and on water resources and agriculture in Africa. This allows us to examine the constraints on inferring useful climate information from climate predictions, and from a policy perspective.

We are also demonstrating a methodology for probabilistic attribution of extreme weather at the scales relevant to specific impacts. The meteorological

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Deputy Leader:
Dr Alex Haxeltine, University of East Anglia



Constructing energy futures

What are the pathways to global decarbonisation?

summary

Avoiding dangerous climate change might ultimately require industrialised nations to cut emissions by between 80 per cent and 95 per cent, while developing nations grow their economies. Whatever greenhouse gas target guides future international policy, maintaining acceptable carbon dioxide emissions requires action at both personal and institutional levels. With this research programme we will understand better the challenges of rapid decarbonisation and the methods to achieve it.

Our research incorporates cultural, political and institutional factors along with technical, economic and scientific analyses, with an emphasis on international decarbonisation over the next 50 years. We are developing comprehensive and systems level approaches to decarbonisation both within the UK and within an international framework, working from the level of national energy systems, to carbon intensive sectors, and to the household level and personal behaviour. We listen very carefully to business, government and international trade organisations.

tasks

Avoiding carbon lock-in by industrialising nations

While industrialised nations find it difficult to make effective changes to decarbonise, industrialising countries face the challenge of growing their economies, whilst reducing carbon intensity. We are studying the nature, determinants and methods of avoiding carbon “lock-in” by industrialising nations, by focusing on constraints within a nation’s energy system, mechanisms for technology transfer, and the extent for technological “leap-frogging” fossil fuelled electricity

Effective energy and emissions accounting

Aviation and shipping are growth sectors estimated to produce a high proportion of carbon dioxide emissions in industrialised countries during the next decades but are currently not accounted for in national inventories of greenhouse gases. If these emissions are not accounted for, any policies to achieve a concerted greenhouse gas emissions reduction target will be ineffective because of faulty and incomplete accounting. We are developing a model that enables policy makers to explore the carbon implications of an energy system as a whole, or by its components, and to compare it with competing options. We are also refining the energy-carbon scenarios for the UK produced in Tyndall’s Phase 1, creating new scenarios for other countries, and producing detailed carbon footprints for energy and transport.

Driving low carbon freight

As the global economy expands, imports and exports are one of the fastest growing sectors in emissions, creating a need for practical policy options aiming to reduce the greenhouse gas pollution of this economic sector. We are

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Dr Kevin Anderson, University of Manchester

Deputy Leaders:
Dr Jim Watson, University of Sussex,
and Dr Sarah Mander, University of Manchester



exploring the carbon implications of international freight by evaluating the consequences of a concerted carbon-reduction strategy and assessing the potential of alternatives such as high-speed rail. Our research includes the creation of a global freight carbon emissions database and an evaluation of carbon mitigation options in this sector

Studying carbon reduction instruments for individuals

The proposed use of carbon reduction schemes such as Domestic Tradable Quotas, carbon taxes, or an extension of the EU Emission Trading Scheme, could effectively help to achieve strict carbon emissions reduction targets for the UK. However, they raise issues such as their fairness to people on lower incomes, set-up and running costs, and implementation problems such as eligibility, public acceptability, and technological and administrative feasibility. We are using econometric modelling on existing qualitative work to study whether these personal economic instruments are suitable to achieve strict national carbon targets in both the UK and abroad.

Reducing the demand for aviation

Aviation is the fastest growing sector of greenhouse gas emissions in the UK, and the government faces the challenge of reducing the growth of emissions in a market with increasing demand for flying. We are exploring the social norms and standards of aviation practice; how availability of flight routes creates demand for consumers to travel; the role of the media; and the influence of dispersed networks of friends and peers. We aim to explore ideas for new effective policies and instruments.

Building resilience to climate change

What are the limits to adaptation?

summary

Adaptations to climate change are underway at many scales within society. Adaptation represents a major challenge to sustainability for individuals, households, firms and organisations, and is related to their changes in perceptions of climate risk change.

Tyndall Centre research has already identified key determinants of the capacity of individuals, institutions and societies to adapt, have developed tools for assessing risk, and have shown the constraints that society imposes on adaptation. However, research still needs to identify flexible adaptation options that increase the ability to withstand climate shocks and unexpected events, help organisations to identify and implement adaptation strategies based on knowledge and resources, and allow adaptation and learning in a timely fashion.

We are applying innovative combinations of quantitative and qualitative methods from across natural and social sciences. In our approach we are using social psychology, political science and economics to investigate the social learning of risk perception and evaluation; physical science to estimate uncertainty in the impacts of climate change; and modelling to reveal changes in the ability to adapt over time. We study learning and resource management through vulnerability and resilience approaches and we associate livelihoods analysis with development studies and human geography. We listen very carefully to risk management institutions, governments and community groups.

tasks

Defining the relationship between resilience and adaptation

We already have insights on the key factors influencing adaptation to climate change, and how to measure the limits of adaptation for groups or societies. However, we still need to know how societies can increase their abilities to adapt and how they can identify and implement adaptation strategies within a suitable timeframe. We are developing a framework to characterise the resilience of social-ecological systems by identifying the key aspects of resilient adaptation.

Identifying social, institutional and learning barriers to adaptation

By studying the limits imposed by knowledge and organisational constraints on adaptation to climate change, and by exploring common elements shared with constraints on mitigation, we are tackling the challenge of understanding how societies learn to adapt to climate change at individual or institutional levels.

Exploring global impacts and physical limits to adaptation

Apart from a need to examine the social and organisational limits to adaptation, there is a need to know the physical and technical limits as well. We are identifying these thresholds by characterising the impacts of different rates of climate change on

vulnerable natural and human systems and sectors across the globe, along with feasible adaptations. A specific innovation is our use of representations of local scale adaptation in assessments of global scale impacts.

Quantifying adaptation limits in Africa

Climate change produces gradual changes in climate conditions, but also influences extreme weather events, such as floods, droughts, heat waves and windstorms, imposing on the most vulnerable areas the urgency to adapt. We are doing quantitative and qualitative multi-scale analysis of the conditions that enable adaptation to changes in water availability in the Nile and Limpopo river basins in eastern and southern Africa, to identify factors that enhance and constrain adaptation, and to quantify risks across country boundaries. We are examining the role of development initiatives in achieving national water development requirements.

Leader:

Dr Neil Adger, University of East Anglia

Deputy Leader:

Professor Nigel Arnell, University of Southampton



International development

How can international development be sustained in a warming world?

summary

The development strategies of poor countries are fundamental to climate change adaptation and mitigation. Poverty alleviation and human well-being are crucially threatened by climate change in already vulnerable regions of Africa and Asia. Yet the impacts of past emissions by industrialised countries are most acutely felt by poor people, especially in developing countries. Emissions are also rising rapidly in parts of the developing world. There is a need to bring adaptation and mitigation into development policy agendas, and to design, implement and evaluate international development under the constraints and opportunities of global warming.

We have designed this new research programme knowing that it is vital to effectively engage developing countries into international scientific and policy discussions. The goal of such discussions should be to reduce the contributions of development to global warming and ensure that development itself does not increase the vulnerability of the poor to climate change risks. Africa has special attention in our research because of its particular vulnerability to climate change and to match the priorities of the UK and international initiatives on poverty.

A series of seminars and an African regional Workshop will engage scientists, policy makers, NGOs on issues of implementing effective development in Africa under changing climate conditions, focusing on the design and application of mechanisms to incorporate climate change adaptation and mitigation into development programmes through coordination with donors. We listen very carefully to development agencies, to international donors and to vulnerable people.

tasks

Meta-analysis of vulnerability and adaptation

There is a wealth of empirical studies, from household to regional scale, of vulnerability and adaptation to environmental change from Africa but to date no systematic continent wide analysis exists. We aim to synthesise data on institutional, economic, social and development linkages in order to provide the first continent-scale assessment of the role of climate parameters and climate change on the effectiveness of development programmes and activities.

Mitigation choices for African households

Decarbonisation strategies at the international or national level may have significant adverse impacts on the human welfare of poor communities. We are analysing the interactions between fuel use, health, technological change, gender and social decarbonisation strategies, focusing on the trade-offs between increased prosperity, consumption and environmental health. We aim to provide options for mitigation actions and methods to assess the benefits for the most vulnerable of local-scale technological innovations.

Assessing the transfer of low-carbon energy technologies to developing countries

Because of the high emissions and rapid development of large developing countries, there is a need for research on the design and implementation of effective programmes for transferring decarbonisation technologies to such countries. We are assessing state-led between-nation programmes that transfer low-carbon energy technologies, and focus on how large developing countries such as China, Mexico or South Africa acquire new technical capabilities and skills.

Beyond the millennium goals; development in a warmer world

To date, existing research on climate change and development has focused on the likely impacts of climate change on the attainment of the Millennium Development Goals (MDGs), which represent short-term targets. We are looking beyond the MDGs and are examining the long-term threats to development posed by climate change. We are developing a high-level dialogue between researchers in different disciplines, including climate and economic modelling, policy analysts and resource economists, and constructing alternative visions for development and policy pathways, utilising scenario construction and expert envisioning.

Leader:

Professor Katrina Brown, University of East Anglia

Deputy Leader:

Professor David Thomas, Oxford University



Sustainable coasts

How can shorelines be managed for the third millennium?

summary

Coastal regions account for one quarter of global human habitation and one third of the global economy. They are particularly vulnerable to increased sea levels, changing storms and other climate changes. Significant coastal impacts throughout the twenty-first century and beyond are inevitable without appropriate adaptation. A range of government and non-government organisations, both nationally and internationally, are asking for ways to address this challenge.

Our coastal research tackles the issue by building on the successful development in Phase 1 of integrated methods for analysing adaptation options for the sustainable governance of coastlines. We modelled the effects of climate change on a range of coastal parameters, including landscape-level analysis. During Phase 2 we are developing further integrated tools for coastal simulation and analysis, exploring their practical application to long term coastal management in a range of situations. This requires scaling down climate and socio-economic scenarios from global to local.

The implications of coastal change for coastal resources and social and economic impacts are also being assessed. We are exploring a wide range of adaptation options including flood risk management systems and planned retreat. We are also exploring participation and improvement of coastal governance to respond to climate change, using dialogue and virtual reality methods of visualisation. We listen very carefully to coastal communities, coastal managers and governments.

tasks

Developing a coastal simulator

Climate change brings impacts on coastal ecosystems and communities that require a broad range of adaptations to increased sea levels, changing wave climates and the resulting coastal erosion, increased flood risk and changes in biodiversity and ecosystems. Continuing with the development of a coastal processes simulator is allowing us to identify how the future coastline may evolve. The simulator is the world's first to produce a downscaled analysis applied to a coastal region (in this case Norfolk), linking global changes to local wave climate and regional climate scenarios and their consequences. The simulator integrates components from Phase 1 (climate, hydrodynamic, morphological, ecosystem, societal resources and risks) and new ones such as a sandbank movement model and an agent-based model of urban land use. Many of the simulator concepts will be tested in other coastal regions.

Determining the consequences of coastal change

It is important to establish the right mix of protection and retreat measures that suit the ecological, social, economic and physical integrity of each coastline. The existing coastal simulator is being further developed to enable us to determine what constitutes a sustainable

coastline, by producing assessments for ecosystem, flood and erosion risks under different scenarios of adaptation. We are applying this tool to other vulnerable coastlines.

Promoting coastal management: participation and governance

The challenge of coastal management for adaptation to climate change lies in the variety of required actions with tradeoffs and synergies and the wide range of stakeholders to implement them. We are exploring how best to deliver practical guidelines for shoreline management. Through continuous dialogue with stakeholder communities and analysing the consequences of governance structures we are exploring the most effective methods to promote fairness, sustainability and stakeholder participation in coastal governance.

Leader:

Professor Robert Nicholls, University of Southampton

Deputy Leader:

Professor Andrew Watkinson, University of East Anglia



Engineering cities

How can cities grow while reducing vulnerability and emissions?

summary

Almost 50 per cent of the world's population live in cities, increasing to 60 per cent by 2030. As a result of this, urban emissions will be an increasing driver of global warming. At the same time, urban areas, particularly in coastal regions in the developing world, are vulnerable to climate change and its impacts. In turn, these impacts induce energy-intensive adaptations such as air conditioning, pumped drainage or desalination. The mitigation of these impacts and sustainable options for adaptation in vulnerable cities require integrated strategies involving key stakeholders. Ultimately, we want to understand more about the effects of climate change on cities, the causes of greenhouse gas emissions from urban areas and assess the effectiveness of alternative approaches to mitigation and adaptation.

Our research combines generic developments intended to be widely applicable with place-specific studies to provide convincing demonstrations and to engage with stakeholders. We are working with stakeholders in London and Shanghai to define policy questions not addressed by other initiatives, to provide a vision of future urban strategies for mitigation and adaptation, to understand decision-making processes, and to access datasets and collaborate with researchers from other climate-related initiatives.

Together, these tasks will mean that stakeholders and researchers will understand more about the systemic effects of climate change on cities, will have new insights into greenhouse gas emissions from urban areas, and will be able to conduct model-based assessment of the effectiveness of alternative strategic approaches to mitigation and adaptation. We listen carefully to city authorities, planners and engineers.

tasks

Delivering a blueprint for an urban integrated assessment facility

Mitigating and adapting to climate change in urban areas involves complex interactions of citizens, organisations and businesses. This complexity can lead to disparate policies, potentially less beneficial than comprehensive integrative ones. We are designing a city-scale integrated assessment tool, along with detailed plans for its implementation and exploitation. The London Climate Change Partnership and the Greater London Authority are involved from the initial stage to prioritise stakeholder objectives and questions

Generating scenarios of urban land use and attributes

The creation of a city-scale emissions accounting tool requires adequate support from geographical information systems in terms of land use scenarios and other attributes that can be used in modelling and simulations. We are developing and demonstrating a downscaling methodology for generating scenarios of urban economic indicators and attributes that are consistent with variables used in global economic and climate simulations. This is providing us with the context for assessment of climate change impacts, adaptation and mitigation at the urban scale.

Developing a city-scale emissions accounting tool

While urban carbon dioxide emissions are an increasing driver of global warming, cities have much scope for using alternative sources of energy and implementing mitigation and adaptation measures. For effective policy we need simple emissions accounting tools to quantify the effect of different combinations of alternative energies and policies on urban emissions. Based upon existing approaches we are developing and demonstrating a new city-scale greenhouse gas emissions accounting tool. It is utilising a simple method based on available economic, demographic, human behavioural, land use, built environment, technological, transportation and climate indicators

Urban transportation emissions accounting

To complement the above task we are producing a transport emissions accounting tool including freight transport that can be used at the city scale to evaluate a range of policy options for reducing urban emissions from transport.

Evaluating and implementing impact assessment modules

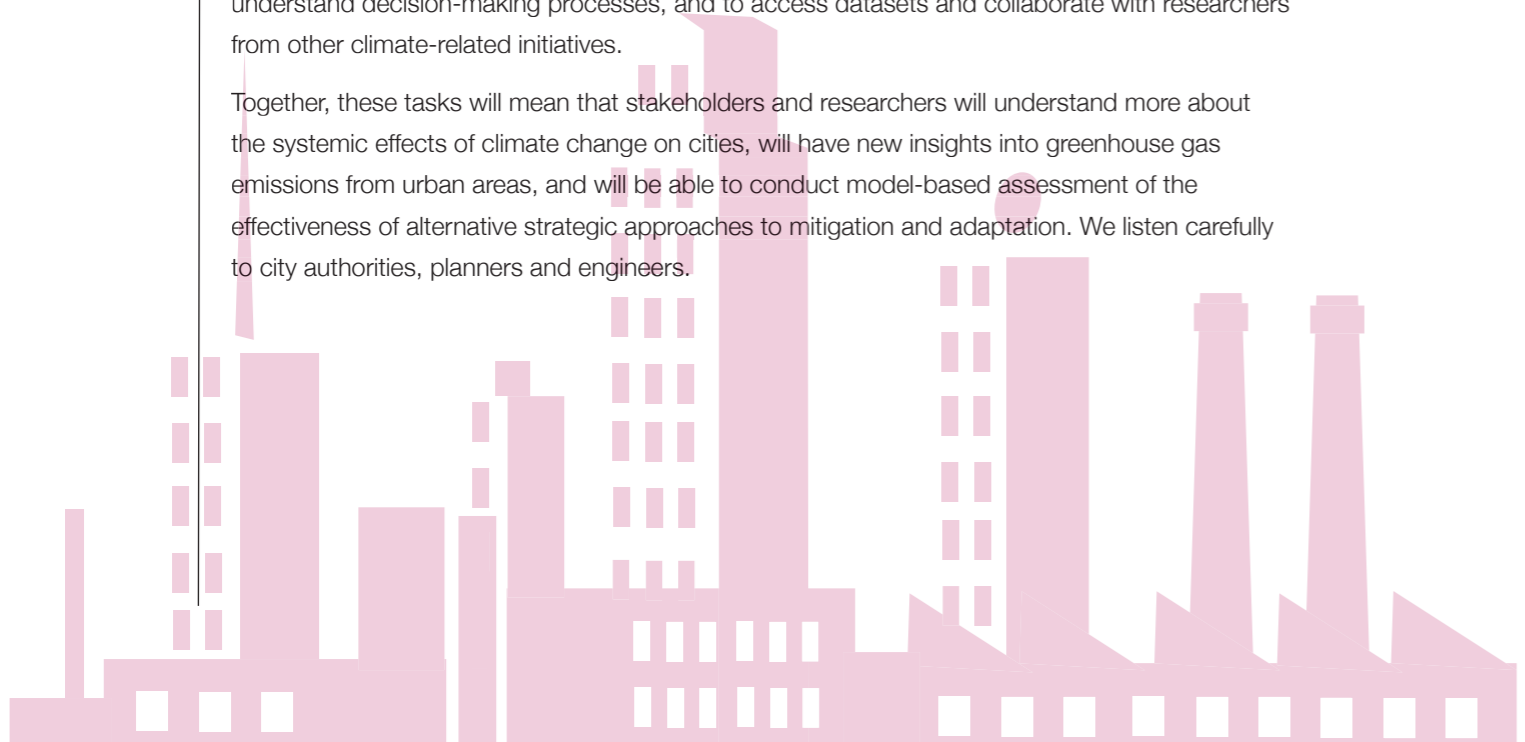
Flooding, health risks from high temperatures, and scarcity of freshwater are high risk impacts induced by climate change in urban areas. To understand cost-effective adaptation measures for these impacts, we are developing a suit of impacts assessment modules.

Leader:

Professor Jim Hall, University of Newcastle

Deputy Leader:

Dr Miles Tight, University of Leeds



Integrated modelling

Innovating Integrated Assessment Systems

summary

Better climate change decision making requires an overall integrated assessment of the complex relationships between the physical, biological and social systems involved. Hence in phase 1 of the Tyndall Centre we developed the Community Integrated Assessment System (CIAS) as a tool to study the implications of different political, economic and technological choices for climate change. CIAS is operated through a web portal and contains an energy-environment-economic model which simulates the dynamics of technological change (called E3MG), two alternative climate models of different complexity (called MAGICC and GENIE-1) and a simple tool representing climate impacts (called ICLIPS, from the Potsdam Institute). It has enabled us to carry out a preliminary study of climate stabilisation scenarios.

In phase 2 of the Tyndall Centre we are building on this by including more detailed simulations of the effectiveness of different policies in reducing climate change impacts in different sectors and regions, and including interactions between these climate impacts and the economy, which are generally omitted from integrated assessment models.

Unlike previous integrated assessment models, CIAS has been designed as a flexible tool which allows scientists from different institutions to couple together different sets of data modules, even if they are written in different computer languages, on different computer platforms, or located in different countries. CIAS is well placed to study the robustness of policy advice relevant to different modules and at different institutions. In phase 2 we are taking advantage of this capability by extending the set of climate and economic models within CIAS, and complementary parallel studies will analyse uncertainty in individual modules. Together the two assessments help provide a whole system uncertainty analysis for policy makers.

We listen very carefully to government stakeholders, scientific modellers and negotiators.

tasks

Embedding impact modules within CIAS

We are incorporating new representations of water use, sea level rise, changes in crop yields, human health effects and impacts upon ecosystems into CIAS. We are ensuring that the interactions between impacts and the economy and development pathways are taken into account. Linkages to further components of GENIE-1 are being explored to include abrupt climate changes

Modelling induced technological change and diffusion

The E3MG model allows for the representation in climate stabilisation scenarios of future electricity generation options such as micro-CHP, renewables, carbon capture and nuclear. Modelling the effects of policies on these options is the focus for the current research. This work in turn supports quantitative analysis of the effect of different policy regimes on direct investment, technology transfer, technological change and economic growth.

Devising a simple comprehensive damage module for CIAS

We are developing a simple comprehensive approach to impact and policy assessments. Damage sectors such as water, coasts and agriculture will be included. A multi-criteria analysis will allow the user to select

different value schemes in the feedback of impacts of the economy. The influence of value judgements in the assessment of the benefits of mitigation will then become apparent. Simple representations of extreme weather events and abrupt climate change will be also be simulated.

Preparing robust CIAS scenarios for climate stabilisation

We are working with Defra stakeholders to produce a set of standard CIAS climate stabilisation scenarios where we can explore the effectiveness of policy choices including instruments designed to promote and transfer technological change. We are assessing the robustness of these scenarios by analysing the uncertainty arising from using different modelling approaches such as the use of simple or intermediate complexity climate models using the flexibility of CIAS and from the assumptions used in these models, such as climate sensitivity, carbon cycle feedbacks, damage costs and oil prices.

Leader:

Dr Terry Barker, University of Cambridge

Deputy Leader:

Dr Rachel Warren, University of East Anglia





Knowledge transfer and engagement

We will continue to engage a wide range of new and established users and audiences from the policy, business, NGO and research communities, using our research findings to inform the ways in which we engage the public with climate change.

We need to ensure that Tyndall Centre research is useful for its end users and answers their questions. Each Research Programme has a stakeholder panel to ensure dialogue between the research teams and their key stakeholders. An external Stakeholder Advisor counsels the Centre on its engagement activities, facilitating networking with national and international organisations, businesses and governments, and opening opportunities for fund-raising and development.

Knowledge transfer

Our communication and knowledge transfer efforts are designed to ensure that we reach and inform key target audiences. Each Research Programme has a knowledge transfer and communications plan to further our goal of embedding engagement into the research process. This situates knowledge transfer as a strategic activity of all senior researchers.

Engaging with the media

The Tyndall Centre remains one of the first organisations that journalists call when they are interested in climate change research expertise. We seek to proactively inform journalists and offer expert comment, articles and letters, and respond to distorting articles where appropriate. We aim to keep our good relationships with environment and science correspondents, and the regional media in those regions where we have a research base. All research staff are trained in media techniques.

Offering publications

We offer a growing catalogue of free publications along with a list of non-technical publications and electronic newsletters to help internationally disseminate our activities. www.tyndall.ac.uk is the most effective way worldwide to disseminate our topical news, deliver online Working Papers, Briefing Notes and Technical Reports. All of our

publications are free of charge, do not require registration, and are made available to other online libraries. Our website is continually revised to deliver information to our targeted audiences.

Science and society

Because of high demand, we prioritise the general public as a secondary though essential audience for the Centre, working with the media as the most direct route to informing mass audiences. We will nevertheless look to pioneer novel engagement opportunities around climate change, as we achieved in Phase I.

Governance

We have established a constitution that sets out the mode of operation and composition of the Centre's governance, consultative and advisory bodies and the roles of senior staff and of core partner Universities. The constitution establishes the following bodies:

- The Tyndall Council is the internal management body responsible for medium and long term policy and strategy. Meeting every four months, it includes the Directors, Research Programme Leaders, Partner Co-ordinators, Communication Manager, Senior Administrator, four elected postdoctoral researchers or PhD students and one Research Council observer.
- The Tyndall Assembly is a consultative annual forum of all Tyndall Centre staff, students, stakeholders associated to Tyndall, and Research Council representatives.
- The International Science Board is a bi-annual meeting of eight international scientists, convened by the Centre's Distinguished Scientific Advisor, to review the scientific quality of the Centre's research and its international presence, and to provide strategic scientific advice to the Director.
- The Supervisory Board is constituted by the funding Research Councils.

Tyndall Partners

University of East Anglia

(Schools of Environmental Sciences, Biological Sciences and Development Studies)

University of Manchester

(Schools of Mechanical, Aerospace & Civil Engineering (MACE), Manchester Business School and Environment & Development)

University of Southampton

(Schools of Geography, Civil Engineering & Environment, Engineering Sciences, and Ocean & Earth Science, including the National Oceanography Centre)

University of Oxford

(Environmental Change Institute; Department of Physics; School of Geography and the Environment; Säid Business School).

University of Newcastle

(Institute for Research on Environment and Sustainability)

University of Sussex

(Science and Technology Policy Research (SPRU); Institute of Development Studies)

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Institute for Transport Studies, University of Leeds (Dr Miles Tight)

Department of Geography, University of Durham (Dr Harriet Bulkeley)

British Geological Survey (Dr John Rees)

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Tyndall°Centre

for Climate Change Research



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