We spoke to researchers and stakeholders about what they thought important.

They said that the Tyndall Centre for Climate Change Research is needed more than ever since its founding in 2000. The last decade was the warmest on record, CO₂ concentration in the atmosphere increased, the world population became larger and more urban, and the demand for food, fuel, and natural resources grew. They also said that the last decade has seen the rise of rapidly industrialising economies including China, India, South Africa, Brazil, new energy technologies and digital communication, carbon trading, and increased public awareness and debate about climate change. They said that there are several emerging areas where the Tyndall Centre can provide new scientific input.

This is what we decided to do

We believe from what we have heard that there is an increasing need for the type of interdisciplinary research and analysis that we do. The Tyndall Centre's first decade focused on interdisciplinary climate change research. Our second decade will in addition focus on the interactions and feedbacks between climate, people and ecosystems. Interactions are particularly important because of their direct impact on human wellbeing. They may trigger inadvertent consequences or provide opportunities and additional benefits. In this spirit we reemphasise the goals of the Tyndall Centre:

- **We will perform internationally recognised, high quality and interdisciplinary climate change research**

- **We will raise awareness of the risks, tradeoffs and opportunities arising from climate change and related environment, energy and economic concerns**

- **We will exert an influence on the design and achievability of national and international climate change related policies and actions**

A key aspect for the next decade is our expansion to the Fudan Tyndall Centre in Shanghai, which both brings aboard new expertise and culture, and engages policymakers in China’s world-influencing and rapidly expanding economy.

We go far beyond the capacity of any individual University in the world. We are successfully transitioning from a core-funded to a competitively-funded institute and to do this we recognise our unique qualities as a world-class network that stimulates ideas and nurtures knowledge, expertise and engagement.
Our Research Strategy

After listening and discussing we have reorganised our research around four broad themes of complementary expertise. Within each theme we have identified key questions that we want to answer and many important questions sit at the intersections of our themes.

The Tyndall Centre’s research themes, interactions and connections

Energy and Emissions

We believe that the challenges of developing and maintaining low carbon energy systems will grow as changes in climate combine with existing trends in population and consumption. We are identifying policy pathways of energy development that complement goals of economic development. We explore near and long-term energy and emissions futures; we understand interactions, trade-offs and uncertainties; and we learn how to transition cost-effectively to a low carbon economy.

- What are the technological and social changes needed for a low carbon future? Are they realistic? How will they impact economies?
- What can we learn from historical technology transitions about the prospects for future change?
- How can we reduce emissions rapidly and substantially in the near-term?
- What are the potentials and barriers to technological and behavioural change and how do these inter-relate?
- How do mitigation actions interact with energy security, energy access and economic growth?
- How can low carbon international development be achieved?
- What are the wider issues of geoengineering proposals?

Capabilities

The Tyndall Centre emissions scenario tool was the first to integrate fully the energy system and include CO₂ emissions from land, sea and air transport. First published as Decarbonising the UK, it integrates the perspectives of energy analysts, engineers, economists and social and environmental scientists to provide a whole system understanding of how the UK government can achieve its reduction targets. The method has since been applied to China and now Russia.

E3MG (Energy-Environment-Economy Global) was developed at Cambridge University to analyse long-term macro-economic energy and environment interactions within the global economy and to assess short, medium and long-term impacts of climate change policy.

The Global Carbon Project’s UK office is hosted by the Tyndall Centre at the University of East Anglia to help in the international effort to provide objective scientific data to policy-makers and the public on the latest trends in carbon emissions and sinks around the world.
Cities and Coasts
We aim to provide scientific information to enable citizens of cities and coasts to be resilient to climate change impacts, emit less pollution, reduce emissions while enhancing economies, and consume fewer resources by optimizing the use of land. An integrated perspective is essential to avoid conflicts between economic prosperity and sustainability. We work to extend and internationalise our flagship capabilities the Coastal Simulator and the Urban Integrated Assessment Facility, and to further emphasize governance and wellbeing as essential management criteria in our modelling.

- What are the impacts and interactions between global change and the urban and coastal environments?
- How do policies in urban and coastal environments amplify or mitigate the effects of global change?
- How can we optimize the use of land and realise its full value?
- How can cities grow while reducing their carbon emissions?
- How can we improve water and human security in urban environments, and reduce their vulnerability to extreme climate and pollution events?

Water and Land
We focus on the availability, use and governance of water, ecosystems and land resources and how they interact with climate change. We aim to determine the barriers and policy solutions to ensure food, water, energy and human security in a changing climate, using a diverse set of methods and interdisciplinary approaches. We also look at the emerging water-food-energy nexus, and identify the global trade-offs between adaptation and mitigation policies using our Community Integrated Assessment System and other modes of integrated assessment of issues and policies.

- What are the drivers and impacts of land use change and land use practices and how are they influenced by policy, economic development, population growth and local opinion?
- What are the synergies and conflicts between climate change policies and land use policies?
- What are the trade-offs between different types of water and land use for achieving food security, energy security, environmental protection, and climate adaptation and mitigation?
- What are the global trade-offs between adaptation and mitigation for water and land use?
- What are the risks to human security of increasing pressures on water and land, and might these produce new areas of national and international conflict?

Capabilities
The Tyndall Coastal Simulator links a suite of separate models to simulate complex coastal processes. The software provides long-term integrated assessments that support future management planning under climate change, socio-economic development and different adaptation options. We developed it for the UK’s complex and eroding East Anglian coastline and we seek to extend it to other areas. It includes an interface to query and visualise results which stakeholders find useful.

The Tyndall Urban Integrated Assessment Facility (UIAF) provides a framework for exploring a wide range of adaptation and mitigation policies at the city scale. For the case-study of London the program downscales socio-economic and climate scenarios coupled with a regional economic model, land use model, climate impacts, and emissions accounting. The UIAF is applicable to other cities.

Capabilities
The Community Integrated Assessment System (CIAS) is a unique multi-institutional modular and flexible program for modelling climate change and sustainable development. CIAS quantifies interactions between the global economy, greenhouse gas emissions, the earth system and its climate, the potential impacts of climate change upon human and natural systems, and the impacts on the distribution of species. CIAS is the first UK framework for assessing rational and international policy decisions and for testing adaptation and mitigation actions.

Tyndall Manchester has developed a novel integrated approach to assess the sustainability implications of bioenergy. Tyndall Manchester is the headquarters of the Supergen Hub.
Governance and Behaviour

We are unique among climate change research centres in analysing individual behaviour and societal concerns for dealing with climate risks and the challenge of decarbonisation. Our insights build on emerging thinking in psychology, political science, sociology and human geography. We investigate the triggers for new policy, the influence of scientific advice on policy, governance and citizens decision-making for adaptation to climate change. We also look at public perceptions, behaviour change and publicly acceptable energy policies.

- What conditions trigger policy innovations?
- What will support success in international policy mechanisms such as REDD?
- How can mitigation and adaptation objectives be mainstreamed across sectors to deliver goals?
- What policies are publicly acceptable?
- What influences public attitudes and risk perception?
- How do individuals, households and communities respond to climate change? What actions and lifestyle changes are most effective?
- What is the influence of scientific advice on climate policy?
- How can climate change and climate risk be communicated more effectively?

We are branching-out overseas

We have recently expanded our network of partners to include the Fudan Tyndall Centre at Fudan University in Shanghai, one of China’s top Universities. This partnership creates new opportunities for collaborative research bringing-in Chinese expertise in demography, economy, pollution, health, urban design and ecology. In addition, China is becoming one of the world’s most powerful economies and their emissions pathway will strongly influence global climate change. The Fudan Tyndall Centre ambitions are focused around greenhouse gas stabilisation and transition to a low carbon economy; food, water and human security; and building resilience and reducing vulnerability of people and places. Tyndall know-how and modelling capabilities will greatly contribute to these key questions and benefit from these new international links.

We think it important to talk about climate change

In support of our research strategy our communication maintains an emphasis on engaging target audiences with our new research and ideas. We pay new attention to international audiences, in particular China. Tyndall’s target audiences are policymakers and stakeholders, funders, the wider academic community, and the general public. We continue to use traditional and utilise new media as routes for dialogue with our audiences. We aim to have evidence-based communication that applies new understanding to the way that we engage with the public.

We welcome your suggestions on our future research. Please contact Professor Corinne Le Quéré, Tyndall Centre Director c.lequere@uea.ac.uk
We think these are our main research achievements so far

Aim for two degrees but plan for four

The probabilities of exceeding the 2 degree ambition have increased since 2000 and overshooting 2 degrees is now widely discussed. We raised awareness of the need to plan for increased climate change while keeping the emissions target intact.

The economics of climate change policies

The E3MG energy-environment-economy model at Cambridge University has informed the Stern Review, the IPCC Assessments, UNFCCC negotiations and many governments including Mexico, the second country in the world to have a Climate Change Act.

Decarbonising the UK and China

Tyndall Manchester devised integrated whole economy scenarios for the UK, which we believe influenced the UK government’s journey towards national climate change targets. Tyndall Sussex extended the methodology to China, and new work is underway for Russia.

Local impacts of international climate policies

Tyndall UEA and Oxford have examined the problems and benefits to local communities of global policies designed to increase clean energy in developing countries (CDM) and reduce land use emissions by preventing deforestation (REDD), raising awareness of the governance challenges of UNFCCC policies.

Urban climate change

Tyndall Newcastle developed the Urban Integrated Assessment Facility (UIAF) to assess the interactions between climate, economy, population and infrastructure in London, the first time an integrated assessment had been applied to a city. It informed the London Plan.

Human dimensions of climate adaptation

Our work on defining the physical and social limits to adaptation, fairness in sharing the burden of adaptation, and societal resilience has underpinned theoretical and practical thinking about the human dimensions of climate change and what motivates society to adapt.

Coastal climate change

The Tyndall Coastal Simulator from Tyndall Southampton is the first integrated assessment of a coastal zone, work done on behalf of better science and the people and organisations living on the eroding coastline of North Norfolk.

Engaging the public with climate change

Tyndall Cardiff have helped define effective communication, engagement and behaviour change strategies for use by policy-makers and practitioners. They have introduced evidence to engaging the public with climate change and energy issues.

Co-production of research

Since the inception of the Tyndall Centre we have ensured our research has maximum impact by engaging with stakeholders at the outset of our research. Pathways to Impact are now a standard part of any UK research application.

Training

Thirty-two PhDs have successfully graduated from the Tyndall Centre partner Universities and another thirty-eight are in training. We think of our graduates as interdisciplinary geniuses infecting international research and policy with whole-system analysis.