

Energy Futures Lab

# Policy and Innovation

## Research Overview



### The way ahead

This Research Overview highlights how scientists, engineers and economists at Imperial help shape energy policy and promote innovation, in particular in the area of greenhouse gas mitigation. Research includes identifying issues relevant to future policymaking, developing methods to assess and compare competing claims, analysing the evidence base for various policies and highlighting areas where there is an absence of information or where the available evidence is contested. It also examines the work of Imperial Innovations, which helps commercialise ideas generated by academic researchers.

### Making a map

Developing an energy policy that will slash emissions of carbon dioxide while ensuring that the UK has a secure and affordable energy supply will be extremely challenging. The UK has an ambitious goal to deliver an 80% cut in carbon emissions by 2050. Professor Tim Green, Director of the Energy Futures Lab, says, “The UK is seeking to develop a diverse, low-carbon energy mix including renewables, nuclear power and carbon capture and storage, and to promote energy efficiency and reduce demand. We must link robust science and engineering into policy, so that we inform policy makers with the evidence from our science and engineering, and we must ensure that our evidence has impact.”

### Devising a route

Many analysts believe that technology and innovation policy are essential to delivering the required cuts in carbon-dioxide emissions. Sir Nicholas Stern, who conducted a review of the economic and social costs of climate change, identified technology policy—alongside carbon pricing and the removal of barriers to behavioural change—as essential to combating global warming. He recommended that government should collaborate with industry to stimulate the development of a broad portfolio of affordable, low-carbon technologies and that it should also promote new technologies directly.

Innovation in energy technology is rapid. Electric vehicles and solar photovoltaic power could transform society in the coming few years, according to McKinsey, which warned, “Companies must be aware of the price and performance thresholds that will trigger massive shifts in demand for each relevant technology. Those that neglect what is happening on the margins today put themselves at risk of being pushed to the margins themselves in the not-too-distant future.” Developing a better understanding of how low-carbon energy technologies can be created, implemented and adopted is therefore crucial if the UK is to prosper from the experience of cutting its carbon-dioxide emissions.



## Navigation systems

Dr Robert Gross, Policy Director at the Energy Futures Lab, runs a research team focused upon the technical and economic assessment of low-carbon energy technologies. Issues include how prices fall when a particular technology becomes widely adopted and how a dominant technology or system can impede the development of alternatives. He says, “We do research that sits at the interface between science, technology and policy and we identify issues that need to be looked at that are relevant to future policymaking.”

Most renewable-energy technologies are more expensive than fossil fuels under today’s market conditions and so rely on various forms of government incentives to make them attractive to investors. Dr Gross thinks that government should move away from simplistic notions that governments should not pick winners and target support such that it drives innovation in renewable energy, carbon capture and storage. This tailored approach, driven by an understanding of technology and innovation, contrasts strongly with the solutions advocated by some economists and policy analysts, particularly those with less focus on technical change. He says, “Having a price on carbon is a necessary but insufficient mechanism to promote the deployment of low-carbon technology. Neoclassical concepts of external costs are not wrong, but policy needs to do more in order to harness innovation and encourage investment in low carbon energy.”

Dr Gross and his colleagues also work to ensure that policymakers are informed by the best evidence and analysis, which can mean working to counter overly simplistic or doctrinal solutions. “Sometimes, bad ideas become fashionable, we need to acknowledge this and bring evidence to counter them,” he says. “There are two types of contest: myths and realities that are complicated; and conceptual differences where there is an absence of evidence or where the evidence which is available is difficult and vexed.”

He also reaches out to policymakers. Because politicians do not generally read academic papers, Dr Gross takes his research directly to them, by writing accessible versions of his papers, speaking to civil servants and parliamentarians who serve on select committees and by serving alongside government officials on working groups in low-carbon energy policy.

## A sense of direction

Moving to low-carbon energy sources and infrastructures requires not just technological innovation but also business, cultural and institutional innovation. Staff at the Energy Business Research Lab at Imperial conduct research on the strategic, managerial, institutional, economic and social aspects of innovation, adoption and knowledge transfer as they relate to sustainable energy technologies.



(Top) Professor Gerry George works on resource-constrained innovation, including rural electrification in Kenya and Tanzania.

(Left) Professor Richard Green works in Imperial’s Business School, studying the economics and regulation of the electricity industry.

(Right) Dr Robert Gross is Policy Director of the Energy Futures Lab, and heads research into how policy and can help the development of emerging technologies.



Professor Richard Green, Professor of Sustainable Energy Business, is investigating the impact of the UK moving to a low-carbon electricity system and how to make low-carbon technologies attractive to business. Different policies for pricing carbon, support for relatively expensive but low-carbon technologies and charging for electricity transmission all affect the incentives for investment. “We will only be able to make use of new technologies if companies are willing to invest in them. They must believe that market conditions and government policies will allow them to earn a reasonable return on their investments,” he says.

## Transforming lives

Researchers in the business school seek to identify where business opportunities emerge—and what new business models are needed to pursue them—in the transition to a low-carbon economy. Professor Gerry George, Deputy Principal of the Business School at Imperial, is examining the effect that electrification has on life in rural Kenya, in particular, its effect on the quality of life, health, education and the creation of small enterprises. With his colleagues he is studying two isolated villages that are equidistant from Nairobi, each of which has a modest health centre or chemist, a school and a handful of businesses. One of the villages has been provided with a solar panel to generate electricity and batteries in which to store power; villagers must pay a modest charge to use them. The other village has no such provision. Professor George thinks that electrification will help boost health, because vaccines must be kept cool if they are to be effective, improve education, because children will be able to study after dark, and enable entrepreneurs to establish small businesses, such as the charging of mobile phones. He says, “It is crucial to understand what drives success and failure. Ownership is important, training is also critical.”

## Driving innovation

To ensure that its research remains relevant to the needs of industry, staff at the Energy Futures Lab maintain close links with business and government; Imperial’s corporate partnerships team helps with this activity. For example Professor Geoffrey Maitland of the Department of Chemical Engineering leads a team that conducts research to understand better the carbonate reservoirs in Qatar to enhance oil and gas production, and which investigates the possibility of using the depleted reservoirs for storing carbon dioxide. Promising ideas that emerge from the Energy Futures Lab that could create a new company or a new line of business for an existing one are identified by staff at Imperial Innovations, who help to foster new concepts and bring them to market. For example Professor Nigel Brandon co-founded Ceres Power, a company that makes combined heat and power units for homes. The devices burn gas to generate hot water and electricity locally, which avoids the losses incurred during transmission through the national grid. Staff at the Energy Futures Lab also provide expertise by acting as consultants through Imperial Consultants.

## How energy provision promotes education and entrepreneurialism

The number of people who live in slums in India exceeds the entire population of the UK. Professor Gerry George, Deputy Principal of the Business School at Imperial, recently oversaw a study in the state of Gujarat which examined what happens when energy is supplied to slum dwellers. Members of his team conducted 500 interviews in five different slums, two of which lacked basic services but three of which had recently been supplied with clean water, sanitation and electrical power. The 500 denizens were asked to rank the importance to them of various services, including water, sanitation, floodwater protection, housing, education, health facilities and employment. Those without the basics had a clear order of priorities: water, followed by sanitation, followed by roads then electricity. A house, some land, good health, education and employment were rated less highly. For those slum dwellers who had recently received basic services, the picture was quite different: they rated water, sanitation, roads and electricity relatively lowly but aspired to owning property, education and employment. Professor George says the research demonstrates how investing in energy supply can help boost the economy. He says, “With access to basic infrastructure needs—namely water, sanitation and energy—the slum dwellers shift from focussing on basic needs to improving the quality of their lives. When people aspire for more they tend to go into education and entrepreneurship: people don’t want to become entrepreneurs without their basic needs being met.”







Energy Futures Lab Research Overviews explore the key issues that must be addressed if we are to develop more secure and sustainable energy supplies, and explain how research at Imperial College London paves the way to meeting these challenges. Our staff and students conduct multidisciplinary energy research to cut carbon emissions. With strong links to industry, they develop an integrated view of energy supply, demand and distribution that takes into account technological, environmental, economic and security considerations.

Further articles in the Energy Futures Lab Research Overview series:

- Low Carbon Transport
- Sustainable Power
- Clean Fossil Fuels
- Energy Infrastructure

To find out more about the Energy Futures Lab, or to speak to us about carrying out research, funding us or collaborating with our researchers, please contact:

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