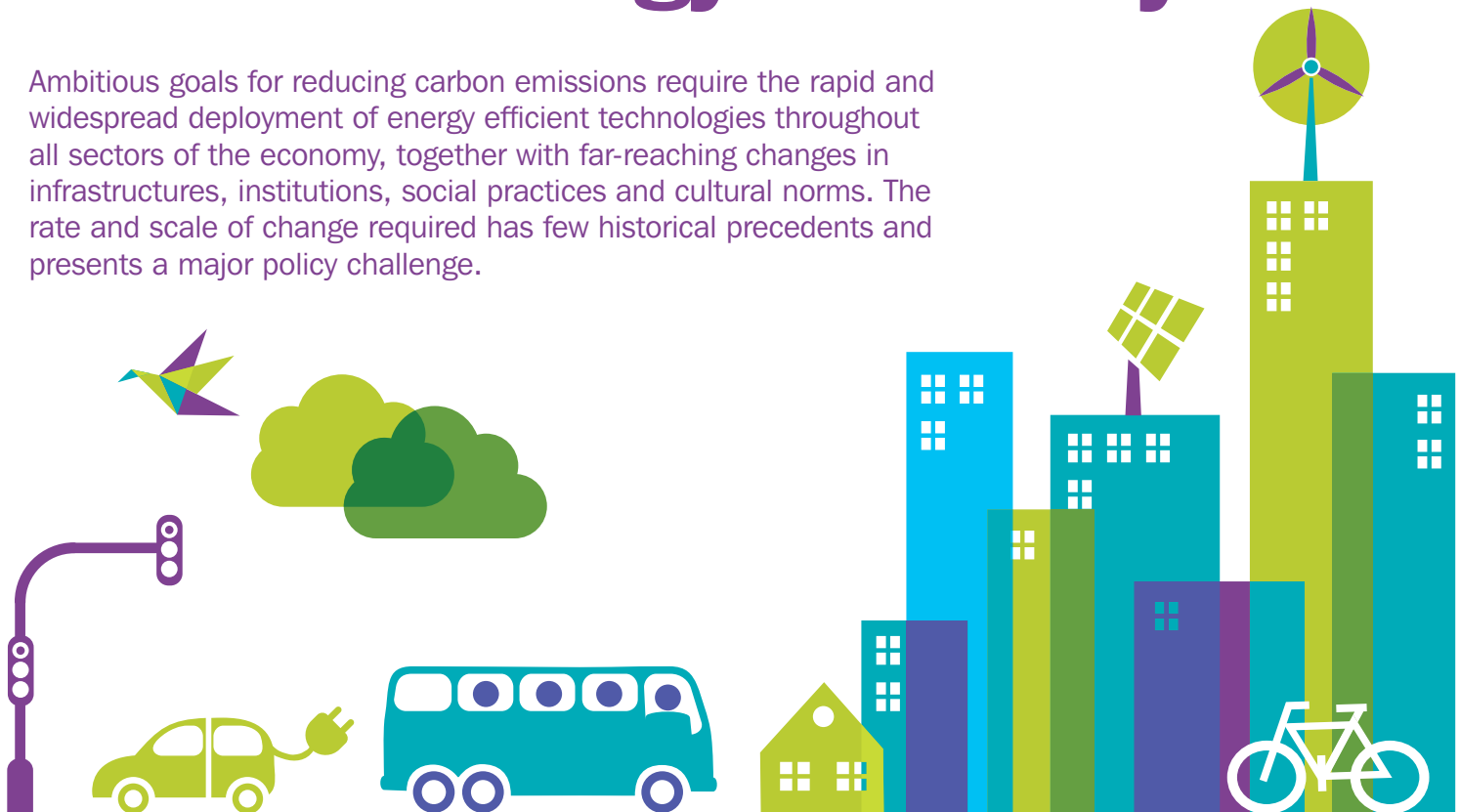




Driving the transition to a low energy economy

Ambitious goals for reducing carbon emissions require the rapid and widespread deployment of energy efficient technologies throughout all sectors of the economy, together with far-reaching changes in infrastructures, institutions, social practices and cultural norms. The rate and scale of change required has few historical precedents and presents a major policy challenge.



The Centre on Innovation and Energy Demand (CIED) contributes to this challenge by developing a socio-technical understanding of the emergence, diffusion and impact of low energy innovations. These include new technologies (e.g. heat pumps), organisational arrangements (e.g. car sharing) and modes of behaviour (e.g. cycling) that are expected to improve energy efficiency and/or reduce energy demand.

We aim to uncover the processes and mechanisms through which different types of innovations become (or fail to become) established, identify the role of different groups, explore the resulting impacts on energy demand, and develop recommendations for both facilitating the diffusion of such innovations and maximising their long-term impact. Through collaboration and engagement with relevant stakeholders, we use this understanding to develop practical policy recommendations.

Our research programme is:

- **interdisciplinary:** drawing upon a variety of perspectives from economics, innovation studies and urban geography;
- **multi-method:** employing historical and contemporary case studies, surveys, econometric analysis, systems dynamics modelling and systematic reviews;
- **broad-based:** investigating low-energy innovations relevant to industry, households, public and commercial buildings and all modes of transport; and
- **relevant:** collaborating with stakeholders and undertaking wide-ranging engagement activities

CIED is a collaboration between researchers from the Sussex Energy Group (SEG) at SPRU, University of Sussex; the Transport Studies Unit (TSU) at the University of Oxford; and the Sustainable Consumption Institute (SCI) at the University of Manchester and is one of six Research Centres on End Use Energy Demand funded by the RCUK Energy Programme.

CIED's research is organised into three research themes: Emergence, Diffusion and Impact. Projects within each theme investigate selected innovations and the overall research programme provides a balanced coverage of empirical domains. Each theme includes 3-5 projects during the life of the Centre, alongside cross-cutting projects to integrate the research findings.

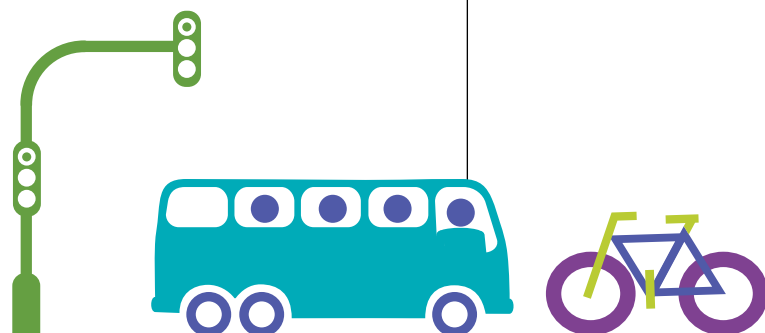
Emergence

Innovation is an uncertain process in which emerging technologies struggle against existing socio-technical systems. To succeed, new innovations need to be 'sheltered' from prevailing selection pressures to provide space for development and learning. This theme studies a limited number of emerging and promising low energy innovations with the aim of better understanding the mechanisms and processes involved and the conditions for success. Example projects:

Innovations in urban transport

Project lead: Dr Tim Schwanen, University of Oxford

Although reducing energy consumption in transport is notoriously difficult, efforts to do so by governments, corporate actors, civic society and citizens have increased markedly over the past decade. The project will identify which factors and processes facilitate and obstruct low energy innovation in urban transport, examine to which extent these factors and processes are transferable across and within city-regions, and provide suggestions about what (local) governments and other stakeholders can do to stimulate the success of such innovations. The methods include document analysis, interviews with government officials and representatives from firms and civic society organisations, and focus groups with users of urban transport systems in various UK city-regions.



Grass roots innovation in low energy digital fabrication

Project lead: Dr Adrian Smith, University of Sussex

Rapid advances in open-source, small-scale digital design and fabrication technologies are opening up new possibilities for decentralised, networked, user-led manufacturing. A confluence of new technologies (e.g. the 3-D printing 'revolution'), new business models (e.g. 'personalised manufacturing'), and new social movements (e.g. 'open-source, commons-based, peer-production'), are prompting claims about the 'reconfiguration' of production and consumption.

This project aims to understand why there is so much interest in these developments, what contending narratives are influential in digital fabrication, how they are shaping material developments, what low energy innovations are arising, or potentially could arise in this setting, and how these developments could be shaped in a low energy direction.

Diffusion

The diffusion of low energy innovations is driven by multiple market and non-market mechanisms and involves interactions between consumers, businesses, policymakers and civil society. Information campaigns and financial incentives can play important roles, but the diffusion of more radical innovations requires adjustments in infrastructures, business models, competences, values, cultural discourses and public policies. The inertia and path dependence of existing socio-technical systems obstruct these adjustments and lead to economic, political and discursive struggles. This theme investigates the processes of diffusion for both incremental and radical low-energy innovations, focusing upon the adoption of innovations by users and the associated changes in practices, meanings, infrastructures and policies. Example projects:

The diffusion of energy service contracting

Project Lead: Dr Steve Sorrell, University of Sussex

Many consider that the transition to a sustainable, low carbon economy will require companies to evolve from selling increasing volumes of products (cars, lights, motors) to efficiently delivering final services to consumers (mobility, illumination, motive power) at lower energy and environmental cost. The project aims to explain the evolution of 'energy service' business models to date, to identify the factors underpinning successful business models, to identify whether, how and under what conditions such models could diffuse more widely, to assess their potential for improving energy efficiency and reducing energy demand and to provide practical recommendations for public policy.

Learning about diffusion from experiences in other countries

Project Lead: Professor Frank Geels, University of Manchester

This project explores the operation, relative importance and interaction of various mechanisms driving the diffusion of 'systemic' low-energy innovations. Since systemic innovations are complex and multi-dimensional, economic drivers of diffusion (e.g. scale and learning economies, performance improvements, network effects), necessarily interact with political and socio-cultural drivers (e.g. policy support, advocacy, institutional change). Alignments between these can overcome inertia and create tipping points and breakthroughs. The project involves in-depth case studies of the diffusion of district heating, light rail and low carbon housing in the last 10-15 years in a selection of European countries (e.g. Sweden, France, Germany), together with a comparison with the corresponding situation in the UK.



Impacts

Economies are complex systems, making it challenging to estimate the historical or possible future impacts of low-energy innovations. In particular, the causal linkages between economic growth, energy efficiency improvements and energy consumption are poorly understood. This theme uses econometric and other techniques to estimate the historical energy savings from low-energy innovations, to explore future energy savings and to identify how they may be increased. Example projects:

Rebound effects in UK transport

Project Lead: Dr Steve Sorrell, University of Sussex

The fuel efficiency of passenger and freight transport has improved significantly in the past few years and there is considerable potential to improve fuel efficiency further. But while a number of policies are focused upon that goal, the economy-wide 'energy savings' may be less than anticipated owing to a variety of unintended consequences. For example, lower running costs may encourage increased ownership and use of private cars, while improvements in engine efficiency and aerodynamics may encourage the development of larger and more powerful cars, rather than more efficient cars. Similar processes are at work within freight transport, where efficiency improvements may lead to more goods being moved over greater distances, as well as encouraging increased consumption of different types of goods, all of which will have consequences for economy-wide energy consumption. This project explores the nature and magnitude of these rebound effects for UK road passenger and freight transport and assess their policy implications. The primary method will be the econometric analysis of aggregate time-series data on UK transport activity, using a variety of specifications and measures, combined with parallel analysis of UK household expenditure and vehicle performance data.

Cross Cutting Projects

Cross-cutting projects synthesise and integrate the diverse lessons about the emergence, diffusion, and impact of low energy innovations emerging from the individual projects and identify specific lessons for UK energy and climate policy. Example projects:

Policy synergies and trade-offs for low energy innovation

Project Lead: Dr Florian Kern, University of Sussex

The aims of this project is to identify policy goals and instruments which potentially foster or obstruct the emergence and diffusion of low-energy innovations in the areas of mobility, heating in buildings, and electricity use. We will analyse these existing policy mixes by identifying gaps, synergies and trade-offs and explain their development over time. This project will inform other projects within the Centre and synthesise policy-relevant insights across Centre projects and research themes.

The research will examine to what extent current UK energy policy goals and instruments add up to a coherent policy mix suitable for fostering transitions towards low energy systems. It will also consider how the emergence and change of policy mixes over time can be explained, look at the impact on the current policy mix and how to improve synergies and avoid trade-offs within such policy mixes.

Developing a relevant and policy focused research portfolio

CIED has established an Advisory Group, involving senior stakeholders in industry, academia, civil society and central and local government. The purpose of the group is to review, challenge and advise CIED researchers on the development of the research portfolio and will also help to ensure the relevance of the work to key debates within UK climate and energy policy. We welcome expressions of interest from anyone interested in collaborating with the centre for the purposes of sharing insights, building knowledge and expertise and engaging people on low energy innovation.

Engagement and impact

We are committed to ensuring that CIED's research is both relevant and accessible to the widest possible range of academic and non-academic audiences. CIED's 'Engagement Hub' helps to ensure our research programme is relevant and accessible and that we respond effectively to policy and other agendas.

The Hub carries out a range of activities including: hosting visitors, organising research and policy workshops, holding conferences, responding to government consultations and contributing to broader policy debates. CIED also collaborates with non-academic organisations on specific questions and problems, while short placements of researchers provide additional resources to those organisations and help researchers gain a deeper understanding of the practical issues they face.

Researcher placements

CIED researchers can undertake placements of up to two months in a relevant practitioner organisation to help them gain a deeper understanding of the issues facing specific sectors and organisations related to their area of research. These placements offer the hosting organisation an additional resource as it is expected that the researcher will undertake active and useful responsibilities during their visit. Contact the Centre Manager if you are interesting in hosting a CIED researcher.



Further information

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