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UK Energy 2050: the Transition to a Secure Low Carbon Energy System for the UK

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About the UK Energy Research Centre (UKERC)

- Created in 2004. Now in *Phase 2* (2009–2014)
- Funded by the Research Councils' *Energy Programme*
- A distributed centre, HQ at Imperial College, that acts as a hub for UK energy academic research
- Informs policy development and research strategy, working with policy-makers and other stakeholders
- Carries out a programme of interdisciplinary research, with partners from over 30 UK universities and other research institutions

RESEARCH COUNCILS' energy PROGRAMME

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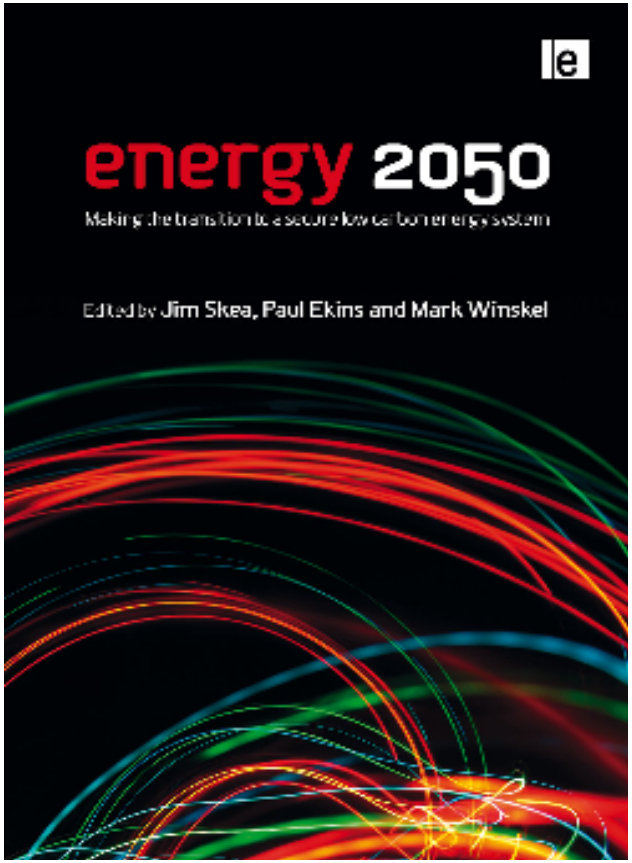
UKERC's *Energy 2050* Project (2007–09)

Shows how the UK could move towards a low-carbon energy system over the next forty years

Focuses on the two primary goals of UK energy policy

- achieving an 80% reduction in carbon emissions by 2050, while…
- ..ensuring that energy services are delivered reliably



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The broad approach

- Not an attempt to forecast the future
- Explores the choices and trade-offs associated with CO_2 reduction and energy resilience
- Combines underpinning scientific insights with scenario approaches to uncertainty
- Makes use of a range of system-level, network and sectoral modelling tools

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Scenarios

- Business as usual
- low carbon
- energy security and resilience
- technology acceleration
- lifestyle and consumption
- socio-environmental sensitivities
- global energy markets

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Key messages

- A low-carbon energy system by 2050 is technically feasible at an affordable cost
- There are multiple possible pathways, but some robust features of the system in 2050 are:
  - 'Close to zero' low carbon electricity
  - Improved energy efficiency
  - Some electrification of heating and transport
- A key trade-off is between reduction in energy demand and decarbonisation of energy supply. Reducing demand is key to rapid progress and insures against:
  - The possible failure of key supply technologies to deliver
  - Public resistance to some supply side technologies
  - Import dependence

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Decarbonisation Pathways

- By 2030, the electricity sector is very low carbon in most scenarios. This allows faster decarbonisation of transport and buildings, using electric vehicles and heat pumps.
- In many scenarios, electricity demand is much higher in 2050 than it is now. Exceptions are where energy demand is reduced faster and more substantial.
- Nuclear power, offshore wind and carbon capture and storage (CCS) could each play a big role in electricity generation
- Oil virtually disappears from the UK energy mix by 2050 in almost any 80% CO_2 reduction scenario

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Technological Innovation

- Accelerated development can assist a number of technologies
  - offshore wind
  - 3rd generation photovoltaics,
  - Marine (wave and tidal flow),
  - 2nd generation bioenergy,
  - fuel cells
  - 3rd generation nuclear fission
- This can give greater diversity in low-carbon supply portfolios
- New technology can reduce the cost of decarbonisation...
- but requires an increased long-term commitment to R,D&D

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Lifestyle Change

- Divergent social and lifestyle futures make a large difference by 2050. Pro-environmental changes could:
  - reduce energy demand in homes and transport by more than 50% below business as usual levels by 2050
  - reduce national energy use and carbon emissions by ~30% below business as usual levels
- These changes would mainly affect the use of oil and gas, the fuels most vulnerable to price rises and interruption
- They would reduce the need for massive electrification to meet tough carbon targets
- They would reduce the overall cost of delivering a low carbon energy system by up to £70 billion

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Environmental and Social Concerns

- Reducing CO_2 emissions generally leads to reductions in other pressures on the environment
- There are exceptions
  - radioactive releases,
  - use of water and land
  - some aspects of air quality

  Bio-energy on a large scale potentially raises significant issues
- This is not a good reason for inaction on a low-carbon society, but it signals areas requiring policy and regulatory attention
  - Public engagement and acceptance are a key aspect of any transition

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Thank You

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