



**UKERC**

# **Report to Supervisory Board**

January – June 2007

# Contents

<b>Executive Summary</b>	<b>3</b>
<b>Response to Mid-Term Review</b>	<b>4</b>
<b>UKERC Activity</b>	<b>4</b>
<b>Theme Networking Highlights</b>	<b>8</b>
<b>Financial Review</b>	<b>10</b>
<b>Appendix 1</b> Demand Reduction theme: response to Supervisory Board comments	<b>11</b>
<b>Appendix 2</b> UKERC Publication Procedures	<b>14</b>
<b>Appendix 3</b>  Themes: - Demand Reduction - Materials for Advanced Energy Systems - Energy Systems and Modelling - Future Sources of Energy - Environmental Sustainability - Energy Infrastructure and Supply  Functions: - Meeting Place - Technology and Policy Assessment - Atlas (Research Register, Energy Data Centre)	<b>17</b>

## Executive Summary

UKERC has continued to make good progress between January-June 2007; there has been an increase in outputs compared to previous periods. Research work within the existing thematic programmes has continued. However, an increasing amount of effort has been devoted to the Integration Project which involves all themes and functions, focusing on the scenarios that will underpin the more interactive work that is being initiated.

A major output has been the modelling work undertaken on behalf of the DTI in support of the Energy White Paper, requiring a substantial improvement in the detail and refinement of the MARKAL-based model which can now be regarded as world-class. There has subsequently been a series of well-attended community consultations which has met the Board's requests for greater interaction with non-UKERC stakeholders.

A further report has been published by the Technology and Policy Assessment function, *Investing in Power*; the subsequent TPA report on the energy efficiency rebound effect will be available in September. This is behind schedule because the scope of the study proved broader than originally understood. The issue of defining well-bounded objectives for future studies has been discussed with the TPA advisory group.

The HQ Directors have continued to be heavily involved in a series of external interactions both nationally and internationally, of which the Commission on Environmental Markets, and the International Partnership for the Hydrogen Economy are two recent examples. The Meeting Place has continued to develop and promote its series of events, and was the prime organiser of UKERC's recent Annual Assembly and Summer School, which echoed the successes of previous years. With support from DBERR, the Summer School model is to be trialled in India this winter through a local institution. The Meeting Place also organised a major international workshop under the aegis of the UK-Japan Low Carbon Society Project.

Development of NERN has been slow, due to a lack of resource and some ambiguity over its differentiation from existing networking activities such as Meeting Place and theme networks. A dedicated person is presently being recruited to rectify the resource issue and a clearer specification of NERN is being developed.

Expenditure is below a simple linear planning projection, due partly to a slow build-up of resource previously reported, and partly to the profile of work in some areas which has not involved contract researchers. Present rates of spend are closer to the simple model, and recruitment will further increase them from late summer onwards.

## Response to Mid-term Review, January 2007

A document has been prepared by the Demand Reduction theme to describe the intellectual structure of its programme. This remains at a draft stage while being discussed within UKERC, but is attached as Appendix 1.

Procedures for publication of UKERC-branded reports and similar documents have been revised to ensure due review. The new procedure as now used is attached as Appendix 2.

Detailed and current financial statements continue to be difficult to obtain due to the distributed nature of UKERC, inflexible or ineffective financial systems at certain institutions, and the complexity introduced by the award-holding institution being separate from the HQ. A summary of the current position as known to HQ, with some attribution of costs, is given on page 10, but this is not a consistent view for all parts of UKERC. Individual themes have provided their own statements of resource expenditure in their reports, but in some cases these are available to them only in terms of personnel presently deployed.

## UKERC Activity

At **HQ** and among its themes and functions, UKERC continues to operate at the cusp of research and policy-making, nationally and internationally. As well as providing support for the FP7 Energy Programme, the EC Hydrogen and Fuel Cells Plan and the Foresight 'Sustainable Energy in the Built Environment' programme, over the last six months, the Centre has played a leading role in hosting the second in a series of Low Carbon Society symposiums, with DEFRA and the Japanese Embassy.

UKERC has also secured funding from DBERR to export its successful annual Summer School – a week long series of lectures and exercises for PhD students - to India.

UKERC's overarching whole systems-based **Integration Project** is providing the common purpose for researchers in the Centre to collaborate on a number of pieces of related work; the proposition is for a scenario-based view of the UK energy system through to 2050 which draws on all of UKERC's themes. Good progress has been made on the Project during the first half of 2007.

Following an internal UKERC-wide meeting in February, a set of scenarios to underpin the project has been outlined. These comprise four core scenarios focusing on the need to work towards energy shocks. The set also include scenario variants addressing issues such as environmental constraints on the development of specific energy sources, the role of human behaviour and lifestyle in determining energy demand, the consequences of and needs for accelerated technological change, and developments in world energy markets. These issues are the mechanism by which researchers across UKERC will be engaged.

Following the publication of the Energy White Paper, the Energy Systems and Modelling theme held two consultative workshops - one internal to UKERC and the other external – to lock in the technical assumptions in the system modelling tools. At the Annual Assembly in June a process was agreed to completely specify the four core scenarios by September 2007 and the scenario variants by

December 2007. Four cross-UKERC working groups have been created to take this forward addressing energy supply, energy demand, infrastructure/networks and policy. The Integration Project has identified the need for further underpinning energy research, especially in relation to the role of behaviour and lifestyles and the characterisation of resilience in energy systems.

The next six months will see an outline proposal for “UKERC: Phase 2” and an associated dialogue on future funding, while broader networking will be formalised with the recruitment of a National Energy Research Network (NERN) manager. A progress report will be developed and distributed across all of our contacts and NERN members outlining our achievements to date.

**UKERC’s profile** continues to grow, with over 84% of media coverage mentioning UKERC quoting one of its members. So far in 2007, 99% of coverage generated has appeared in high quality national media titles/channels including the Financial Times, The Mirror and BBC Online. This result was boosted by the launch of the Technology and Policy Assessment’s Investment in Power report launch and by a UKERC pre-Energy White paper briefing at the Science Media Centre for 20 national journalists, where UKERC spokespeople highlighted and discussed issues thought to feature in the report. Internal communications continued via internal events, chiefly to progress the Integration Project, the Annual Assembly, monthly newsletters and the intranet.

Over the next six months, the focus will be on continuing to generate quality coverage - including via the launch of the Technology and Policy Assessment’s Rebound report - extending communications of UKERC’s work via the NERN network and beyond, formalising a plan to reach Government and policy-making audiences and finally to build a new UKERC website, intranet and NERN extranet.

UKERC has recently awarded **studentships** to a further seven interdisciplinary students, bringing the total awarded since UKERC’s inception to 20. A further seven are planned when UKERC advertises its next round of studentship awards, all of which will conform to UKERC’s ‘whole systems’ approach.

The **Research Atlas** continues to expand. Two new Landscape documents have been added so far this year and a process of peer review has been undertaken for all existing documents.

By the end of the year, all ten Landscapes will be uploaded and peer reviewed.



The Research Register now contains 741 grants (data sources include ESRC, EPSRC, DTI, Carbon Trust and Leverhulme Trust) and has undergone an upgrade, with an improved interface giving users the ability to view expenditure analysis in more detail. Over the next six months, additional grants will be added to total at least 1000; the first batch of NERC data has been obtained and will be processed. In addition, work is underway to allow users to download summaries for input into Excel or Access.

Four detailed research Roadmaps are currently being developed by members of the Future Sources of Energy theme. These cover PV, marine renewables, bio-energy and carbon capture and storage. Each is based on a two-day

professionally facilitated workshop involving academic researchers, business and some individuals from overseas. The PV roadmap is furthest developed and has been taken through an international peer review process. The workshops associated with the others have taken place and final drafts are being prepared prior to peer review.

Meanwhile, the Energy Data Centre archive has been developed, with initial metadata categories assigned and the first batch posted (Elexon data on electricity load profiles). Over the next six months, work will be underway to post data from the Energy Systems and Modelling theme and the Carbon Trust to the EDC.

Finally, UKERC held its third successful Annual Assembly, attracting 80 internal and external attendees, with presentations from external experts including Bernie Bulkin (SDC), Jonathan Stern (Institute for Energy Studies) and Alison Wall (EPSRC). The Integration Project was a major theme, with breakout groups helping to progress the work.

As in previous years UKERC held its Summer School at the same time and place, with 50 PhD student attendees - facilitated by CRAC. Lecturers included Paul Lickiss (Materials, Imperial College), Paul Howarth (Dalton Centre), Sameer Maithel (Greentech, India), Mayer Hillman (independent consultant) and Sarah Mukherjee (BBC). Feedback so far has been extremely positive with every reason to believe that future events will continue, perhaps in an expanded, more international form.

## Themes Summary

Themes have been continuing their research and networking programmes in accordance with their original plans and in parallel with the Integration Project.

**Energy Infrastructure and Supply** has built and completed two models: a generic UK power generation system model of the UK and an optimisation model able to test the interaction of gas and electricity networks. The theme will go on to develop expansion plans based on a simplified UK system for three alternative demand scenarios. It has also completed a paper on the Innovation Funding Incentive and Registered Power Zones and will embark on an in-depth study on regulatory incentives for gas storage investment.

Additional work over the next six months will include studies on the GB gas and electricity network, including gas storage capacity adequacy and sensitivity analyses looking at securing supply, fuel costs, etc.

The **Materials for Advanced Energy Systems** theme is split into four main topics. The Materials for the Hydrogen Economy programme is continuing to research materials for potential hydrogen storage; full characterisation of these is underway and will continue over the next six months. It will also continue to develop intermediate temperature electrolysis cells from both oxygen ion and protonic conductors for the utilisation of waste industrial heat. The Materials for PV topic has achieved success in studying organic solar cells materials, which will continue. The simulation of materials for application in high radiation fluxes continues in the Nuclear Material topic, with studies completed on defect clustering in spinel based materials. Finally, the Carbon Capture and Storage topic has completed simulations of oxygen transport in layered perovskite materials and is embarking on experimental work to assess ceramic composites for their suitability as membrane materials.

A focus for the next six months, as well as the above, will be a collaboration with the Environmental Sustainability theme to determine the environmental impact of new energy materials.

The **Future Sources of Energy** theme is split into seven different topic areas: bioenergy, carbon management, fuel cells, photovoltaics, marine renewables and nuclear fission and fusion (nuclear work is being carried out in association with the theme, rather than as a fundamental component). Roadmapping and the development of landscape documents for the Atlas have been a significant focus for most topics, with the bioenergy and PV landscape documents under peer review. Landscape documents for fuel cells, carbon management, fission and fusion are complete.

The bioenergy topic is appraising roadmaps from the EU, Canada and the US, and following a consultative meeting expects to release a draft roadmap this summer. The PV roadmap is undergoing peer review while the marine renewables topic is developing an international roadmap. Three integrating projects are underway with other themes focusing on lifecycle analysis, learning rates and microgeneration.

**Demand Reduction** has progressed its research programme in terms of personal carbon allowances (PCAs), transport, market transformation and industry. A carbon calculator has been developed, which will become publicly available in the next six months, while research is underway for its scoping study on PCA trials. The transport team continues to build a database containing individual policy instruments while researching the cost effectiveness of carbon abatement in the transport sector. Work is still underway on the "Towards 40% Lifestyle" report. The Industry topic alone has produced seven research papers.

The **Environmental Sustainability** theme is divided into four main areas: bioenergy (this is a combined role across the Environmental Sustainability and Future Sources of Energy themes), offshore, transport and carbon capture and storage. This theme is also leading lifecycle analysis research as part of the Integration project; literary reviews for each topics have been developed. Most work has been centred on roadmaps and landscape documents for the Atlas, with additional review of nuclear landscape documents. This will continue over the next six months.

The **Energy Systems and Modelling** theme's work was integral to the Energy White paper, with quantification of a range of low carbon scenarios generated by MARKAL and MARKAL-Macro models. UK MARKAL is also being used to underpin UKERC's Integration Project, focusing on energy security and carbon reduction. Following extensive stakeholder engagement, reviews, workshops and a major model data and results event, the theme has also completed the extended and revised MARKAL model. Significant progress has also been achieved with macro-econometric modelling, with extensions to the household energy demand sub-model and work underway to update and implement an earlier transport energy sub-model. The capacity for uncertainty analysis has also been incorporated into the latest MDM-E3 model. In addition, two major workshops of innovation and energy systems were held, in conjunction with the Meeting Place.

As well as continuation of the work mentioned above, the next six months will see a series of journal articles on energy system evolution being developed as well as the initiation of projects on deep CO<sub>2</sub> reduction strategies. As lead organiser, the theme will also contribute to an international modelling effort on Low Carbon Societies under a joint Japan-UK programme, with heavy UKERC involvement, designed to report to the 2008 Japanese G8 Presidency.

## Functions Summary

The **Meeting Place** managed and organised a total of 12 activities between January and June matching its aim to run an average of two events per month. The quality of the output has improved, with a greater use of facilitation techniques, thereby delivering substantial research-focused outputs, such as a technology roadmap. For the first time, the Meeting place has collaborated with industry, running a carbon labelling workshop and symposium with Tesco. The next six months will see events with Supergen, a carbon capture and storage workshop with participants from China, the US and the UK and an Energy White Paper seminar hosted in conjunction with the British Institute of Energy Economics (BIEE). In addition, the Meeting place will increase marketing activity to raise its profile and increase international activity.

In June, the **Technology and Policy Assessment** function launched its latest research report on Investment in Electricity, which was extremely well received and which generated an exclusive piece of coverage on page two of the Financial Times, among others. The results of the report were presented to the DTI's Energy White Paper team, energy strategy and energy markets groups, Renewables Advisory Board and to the Carbon Trust. The next six months will see the launch of its third report, on the Rebound Effect and the initiation of its next report, on transport policy interventions.

The Rebound Effect report is now some 12 months behind schedule, primarily due to the scope of the study proving more difficult to limit than had been anticipated by either the research team or the advisory group. A review of the project has now clarified the position, and both the theme leadership and the advisory group have identified improvements needed in management and project specification and selection respectively to avoid a future repetition.

## Theme Networking Highlights

The Future Sources of Energy theme has arranged, hosted or attended around 30 visits or meetings in the UK to develop research or publicise UKERC. It hosted a one day bioenergy research community meeting, which included Supergen Bioenergy, RELU Bioenergy, RELU Biogas and TSEC-BIOSYS. A proposal has been submitted to BBSRC for funding to make this an annual event. It has also submitted advice on carbon capture and storage to the Scottish Executive (Parliament) as well as participating in International Risk Governance Council, Washington, to evolve of a regulatory framework for CCS.

Head of fuel cells topic Nigel Brandon has been appointed as the OSI Focal point in Energy with China. Other visits include Guangzhou Institute for Energy Conversion, Beijing, Dalian University of Technology. The theme also hosted inward mission of Chinese Academy of Engineers in June and presented work of UKERC and FSE.

The Demand Reduction theme has held several meetings with the Treasury and Department for Transport in researching its research on individual policy instruments. Its leader Brenda Boardman, has become a member of EDF's Sustainable Development Panel and has supported work on PCA trials as well as attending 12 meetings/presentations including with Earth Charter, RCEP, SDC and the Joint Committee on the Climate Change Bill.



The Environmental Sustainability theme has embarked on networking activities within its topics. Researchers have presented to the 15th European Biomass meeting presented at workshops, including the CA-OE Environmental Workshop in Denmark, the All Energy conference in Aberdeen and the first international offshore renewable energy network symposium in Norway. For the carbon capture and storage topic has advised the DTI, presented to Alternative Energy at Oxford and at two further meetings on CCS in the Netherlands and India.

The lead of the Materials theme is on the steering committee of the DTI Materials UK Energy materials Working Group. Also, in the last six months, the theme organised a major meeting on materials for energy storage and conversion devices in conjunction with the Meeting place, with participants from 11 countries. The group also organised a workshop in Bangkok to promote ties between South East Asia and the UK.

The Energy Systems and Modelling theme has organised two major international workshops on 'Innovation in energy systems'. It is also the core organizer of an international energy modelling collaborative effort designed to quantify scenarios of low carbon societies (LCS). This involves 12 international modelling teams, with a heavy developing country focus. The output of this project will feed into the G8 Gleneagles dialogue when Japan holds the presidency in 2008 as well as in a special journal issue of Climate Policy. Terry Barker has served as a co-ordinating Lead Author (CLA) on climate change mitigation for the IPCC's Fourth Assessment Report which reported in May 2007 and strategic collaborations have been agreed with MARKAL modelling teams in the USA, Netherlands, Japan and India to share insights and workloads in developing, maintaining and improving the respective models.

Stakeholder relationships have been developed with a range of non-UKERC energy groups in order to tap into expert knowledge and to review the modelling work. These include the Carbon Trust, DTI, DfT, DEFRA, BRE, TSEC biomass, TSEC carbon capture, the various SuperGen consortia, SPRU, Imperial College, Dalton Institute, EON, UK, EDF Energy, other academic institutes and a number of energy consulting firms.

The Technology and Policy Assessment function has strong ties with policy-makers and as well as presenting the findings of their Investing in Power report to various Government departments, is also in meetings with the DTI to revisit the Intermittency report.

## Financial Profile

The table below details the expenditure invoiced by each Theme and Function as at 31 March 2007, the latest invoicing date available.

	Cumulative	Unspent	Budget	% Spent	% of stage payments received
Oxford Demand Reduction	£489,686	£996,894	£1,486,580	32.9%	71.1%
Edinburgh - Future Sources	£360,269	£1,103,341	£1,463,610	24.6%	53.2%
Manchester - Infrastructure	£201,129	£700,176	£901,306	22.3%	48.2%
WBS - Infrastructure	£188,404	£76,716	£265,120	71.1%	153.4%
PSI - Modelling	£218,607	£643,116	£861,723	25.4%	54.8%
Cambridge - Modelling	£167,911	£137,714	£305,625	54.9%	118.6%
CEH - Env Sus	£200,855	£594,685	£795,540	25.2%	54.5%
Imperial - Materials	£447,487	£868,240	£1,315,727	34.0%	73.4%
<b>RESEARCH</b>	<b>£2,274,349</b>	<b>£5,120,883</b>	<b>£7,395,232</b>	<b>30.8%</b>	<b>66.4%</b>
Oxford - Meeting Place	£305,173	£799,930	£1,105,103	27.6%	59.6%
Imperial - TPA	£394,818	£773,105	£1,167,923	33.8%	73.0%
RAL - Portal	£213,439	£317,654	£531,092	40.2%	86.8%
Studentships	£305,685	£439,816	£745,501	41.0%	88.5%
<b>FUNCTIONS</b>	<b>£1,219,115</b>	<b>£2,330,505</b>	<b>£3,549,620</b>	<b>34.3%</b>	<b>74.2%</b>
IMPERIAL HQ	£340,376	£669,369	£1,009,744	33.7%	72.8%
Directors and support	£955,519	£959,879	£1,915,398	49.9%	107.7%
<b>TOTAL</b>	<b>£4,789,358</b>	<b>£9,080,636</b>	<b>£13,869,994</b>	<b>34.5%</b>	<b>74.6%</b>

Overall reported spend rate is below a simple linear projection due to a number of factors previously explained, including delays in recruitment of research staff, a focus on networking and related activity in some themes in the earlier stages, external funding of modelling work in the last 18 months, and invoicing lags within themes.

Current expenditure rates have increased to the level originally projected in most areas, and staffing continues to be reinforced, with an additional 3 being recruited for Demand Reduction as well as a NERN manager.

## Appendix 1

# Demand Reduction Theme: Draft Response to the Supervisory Board's Comments

### **Summary – conceptual framework**

The Demand Reduction programme is focused on carbon and gives greater priority to socio-technical than to economic approaches, because climate change and equity are seen as the two primary concerns.

### **Climate change and demand reduction**

The Demand Reduction research is framed by the UK's target of a 60% reduction in carbon dioxide emissions by 2050. The requirement to achieve an identified, fixed, quantified future goal is a new type of task for policy. In the past, policy has not had to deliver specific, firm outputs in this way. Hence, our focus on climate change mitigation includes evaluating the certainty with which the carbon reductions can be achieved.

Greater equipment efficiency enables energy demand to be reduced while the level of service stays the same, but efficiency in itself does not guarantee a reduction in energy demand, as people may still buy bigger fridges or more light bulbs. It is because of the continuing increase in energy demand, despite advances in energy efficiency, that the theme is Demand Reduction rather than energy efficiency.

In total, Demand Reduction applies to a combination of lower demand for energy through greater energy efficiency, reduced energy services and switching to lower carbon fuels.

### **Equity**

Climate change is an equity issue in both inter- and intra-generation terms, but our research focus is on low-income households in the UK. This is partly to ensure that reducing the threat of climate change does not create additional hardship to the present generation and partly in fulfilment of the Energy White Paper objective that 'every home is adequately and affordably heated'.

The research we are undertaking into the feasibility of personal carbon allowances (PCA) is undertaken because a 'cap and trade' approach might be more equitable and effective than one based solely on prices, such as carbon taxation. With PCA, those who produce below-average carbon emissions have something to trade, which will benefit low-income households, who rarely fly and are less likely to own cars. Additionally, the assumption is that taxation cannot deliver emissions reductions with as much certainty as carbon allowances: thus PCA could fulfil our two criteria of carbon certainty and equity.

Until the details of a PCA scheme have been established, it is not possible to identify the likely costs and benefits and therefore make an accurate comparison with alternatives, such as carbon taxes. Our present research focus is on the design of a trial to test aspects of a PCA scheme, for instance the way people view an 'allowance'.

### **Product policy and Market Transformation**

From a policy perspective, the two main routes to reducing energy demand are through pricing or through policies on more energy efficient products. The effect of higher prices is to encourage people to reduce waste and change behaviour, but also to purchase more efficient equipment. They can only do the latter if the equipment already exists and can be identified, hence our emphasis on product policy, specifically through Market Transformation.

We are extending the concept of Market Transformation more widely, beyond lights and appliances. The team has working towards transforming the markets for cars. For instance, the IMPACT policy database, being assembled at Robert Gordon University's Centre for Transport Policy, collates existing knowledge on the effectiveness of up to 80 transport policies (47 complete so far). These can be assembled into market transformation packages and modelled on the UK Transport Carbon Model being developed by Demand Reduction.

A further extension is through the carbon labelling of products, in conjunction with the retail sector. The label is the first stage of a market transformation process, so that the distribution of products can be identified. The Demand Reduction theme, in conjunction with the Meeting Place, is having discussions with representatives of the various product supply chains, including Tesco, DEFRA and the Carbon Trust. The process of carbon labelling (including the data collection methods) are likely to have profound implications for the constituents members of the food chain, particularly farming and manufacturing.

### **Socio-technical energy systems**

The Demand Reduction programme recognises the socio-technical nature of energy systems – we consider people as rational decision-makers, whether in the home or at work. This is broader than economic rationality and incorporates an understanding of how people use and learn from technology (for instance feedback from meters and monitors), whether ownership and status are important to their self-image (does this affect decisions to install photovoltaics on the roof?), as well as the opportunities provided by the institutional structures (eg how good is public transport).

A primary focus of our research is to explore the possibilities for energy consumers, as citizens, to reduce demand through their consumption choices and their day-to-day actions. We have designed a new form of carbon calculator (*imeasure*) for householders that will give accurate feedback to participants, as well as provide us with data on individual carbon profiles. The latter is non-existent and sorely needed. The expectation is that *imeasure* will be in commercial use later this year.

### **The size of the Demand Reduction team**

The point is well made about the tension between the relatively few people researching Demand Reduction in comparison with the work programme. In recognition of this, the theme together with HQ, are discussing the possibility of appointing a new staff, including a full-time manager. This would provide greater focus and strengthen the core, with the pending replacement of Dr Brenda Boardman (sabbatical and retirement from 1.10.07). The new members are partly required by the changing work load of existing part-time members of the team: the areas where extra support is needed include market transformation, fuel poverty, low and zero carbon technologies (including social and policy aspects of building-integrated renewables) and possibly transport.

**Publications**

*Predict and decide* was reviewed, as it was sent out to 90 people in June 2006 (as listed in the Acknowledgements). The report was significantly revised following receipt of their comments, prior to publication in September. The Research Director of UKERC had been sent an early copy in May 2006 and all comments received from him were incorporated. If 'peer reviewing' only refers to anonymous reviewers, then this did not occur.

The appropriate level of review for the different types of UKERC publications is something that needs to be clarified by UKERC: it is unlikely that all publications have to achieve the most rigorous standard, ie of anonymous peer-review.

## Appendix 2

### UKERC Publication Procedures

All UKERC research should ultimately be published in the peer-reviewed literature. Many outputs will take the form of journal articles, books, book chapters or refereed conference papers. The peer review procedures operated by the publishers are deemed to be sufficient for ensuring that these publications reach required standards. These publications should be notified to UKERC HQ through the regular quarterly reporting cycle in order to maintain an up-to-date publications list reflecting the full range of UKERC outputs. The attribution statement appended to this document should be included in each external publication.

Each substantial piece of research conducted under UKERC auspices ***not published elsewhere*** should result in a formal UKERC report. Since UKERC does not have any legal identity, the reports are, where necessary, published by the researcher's home institution and given whatever identity (description, reference number, etc) and copyright protection required by local procedures. These are then "wrapped" in a UKERC cover and given a UKERC reference number.

### Report Types

1. Research Report – a final report on a piece of work subject to peer review and formal approval.
2. Working Paper – to make results available rapidly prior to publication in the peer-reviewed literature. Individual authors, rather than UKERC, are responsible for the content of working papers.
3. Meeting Report – to record the content and outcome of a meeting, typically those with participation from outside UKERC, such as seminars, workshops, and similar events

### Formats

Template documents must be used and can be found on UKERC's intranet under 'Templates'. Once complete, the document should be emailed to Lex Waspe [lex.waspe@ukerc.ac.uk] for publishing online.

### Approval Process

- UKERC Research Reports are subject to external peer review. The Research Director and Executive Director have ultimate responsibility for the peer review process. The appropriate Co-Director should propose a set of reviewers with appropriate expertise (at least three) to the Research Director initially. The Executive Director and Research Director will approve this list or modify it in consultation with the authors and Co-Director. The Co-Director should then send the draft report out to the reviewers, using the review guidelines which can be found on the UKERC intranet. The authors should then modify the report in light of the reviewers' comments and document any decisions to reject comments. The review material should then be sent to the HQ Directors who will then

approve the report or invite further modifications. Please note it is the review process and the author's response that is approved, not the report's technical contents

- Working Papers should be approved by the Co-Director of the Theme producing them.
- Meeting reports should be approved by the Co-Director of the Theme producing them or the Meeting Place manager.

## Reference Numbers

A central register of numbers is maintained by UKERC HQ's Administrator. Those for Meeting Reports and Working Papers can be issued on telephone request to 020 7594 1574 or by e-mail to [admin@ukerc.ac.uk](mailto:admin@ukerc.ac.uk). Those for Research Reports will be issued as part of the HQ approval process.

## Disclaimers

### **Working papers**

"This Working Paper has been prepared to enable results of on-going work to be made available rapidly. It has been commented on internally at UKERC but has not been subject to a full peer review. [The contents are the responsibility of the author(s) alone and not UKERC.]"

### **Meeting reports**

"This document is a report by the organiser of the content and outcomes of a technical meeting organised as part of UKERC's research programme. It is believed to be an objective record of the meeting but has not necessarily been approved by all the participants."

## Attribution Statement

In external publications (papers, books, chapters), the following statement should be included:

"The research reported in this [paper/chapter/book] was conducted under the auspices of the UK Energy Research Centre which is funded by the Natural Environment Research Council, the Engineering and Physical Sciences Research Council and the Economic and Research Council. Any views expressed are those of the author(s) alone and do not necessarily represent the view of UKERC or the Research Councils. We are grateful to the Research Councils for their support."

If you have any questions, please call Lex on 020 7594 1573 / email [lex.waspe@ukerc.ac.uk](mailto:lex.waspe@ukerc.ac.uk).

## **GUIDELINES FOR PEER REVIEWERS OF UKERC REPORTS**

The following guidance should be sent to prospective reviewers of UKERC reports. This can be tweaked accordingly to individual circumstances (e.g. a review report versus the reporting of primary research, engineering and physical science versus social science etc).

“Thanks you for agreeing to review this draft UK Energy Research Centre report. Your comments will be fed back to the authors and to the UKERC Research and Executive Directors who take the ultimate decision about publication. A brief report (up to 2 pages) would be adequate, but any further comments would be gratefully received. Amendments/comments on the text in “track changes” would also be welcome. In writing your report, could you consider the following issues:

1. Does the paper make a significant and original contribution to the energy research field?
2. Does the paper meet the academic standards that would normally be expected of an international peer-reviewed journal or book?
3. Are references to the existing literature adequate?
4. Is the material presented factually correct?
5. Is all the relevant evidence examined and analysed? Are different interpretations considered?
6. Is the presentation of the report adequate? Are there changes you would recommend to text, tables or diagrams to improve clarity?
7. Taking into account any revisions you may have suggested, do you recommend this report for publication?”



## Appendix 3

### Energy Infrastructure and Supply

	Planned	Actual
<b>January – June 2007</b>		
<b>Work carried out</b>	<p><b>Interactions between gas and electricity networks</b></p> <p>Interactions between gas and electricity networks over an operational period: assessment of the impact of the loss of a gas terminal and storage facility.</p> <p>Extension of the optimisation model, to include:</p> <p>a) Electricity transmission expansion b) Gas transmission expansion</p> <p>Quarterly Intra-theme meetings</p> <p><b>Development of UK-Electricity Infrastructure</b></p> <p>Draft methodology report</p> <p>Building a generic power generation system model of UK.</p> <p>Developing generation expansion plans based on a simplified UK system for three alternative demand scenarios</p> <p><b>Energy infrastructure: Regulatory &amp; policy issues</b></p> <p>Completion of IFI/RPZ paper</p> <p>Drafting offshore wind paper</p>	<p>Report on the optimisation of the combined network over an operational period</p> <p>Model upgraded to deal with gas and electricity expansion plans</p> <p>Quarterly Intra-theme meetings</p> <p>Attended the CESSA (Coordinating Energy Security in Supply Activities) conference, Berlin</p> <p>Draft methodology report complete</p> <p>Model complete</p> <p>Generation expansion plans complete</p> <p>Interaction/meetings with UK Carbon Capture and Storage Consortium</p> <p>Working with International Energy Agency (IEA Task 25) to review studies on integration of wind generation in UK</p> <p>Paper completed - comments</p> <p>Offshore wind paper in progress</p>
<b>Outputs</b>	<p><b>Interactions between gas and electricity networks</b></p> <p>Multi-time period combined gas and electricity network optimisation report</p> <p>The gas and electricity expansion model upgrade will allow optimisation over a planning period (20-30 years) and allow interaction with other expansion tools such</p>	<p>Journal paper submission: multi-time period combined gas and electricity network optimisation – sent to Electric Power Systems Research, Elsevier</p>

	<p>as WASP and MARKAL.</p> <p><b>Development of UK-Electricity Infrastructure</b></p> <p>A Generic UK power generation system model.</p> <p>Least cost generation expansion plans (will be completed by end June 07)</p> <p>Draft methodology report</p> <p>Publications on the integration of renewable energy resources</p>	<p><i>Papers:</i></p> <p>a) State of the art of Design and Operation of Power Systems with Large Amounts of Wind Power, (Summary of IEA Wind collaboration), EWEC 2007 conference, 7-10 May 2007, Milan, Italy</p> <p>b) Impact of wind generation on operation and development of the future UK electricity systems, Electric Power Systems Research, 77 (2007) 1214-1227, Elsevier</p>
<b>July – December 2007</b>		
<b>Activities</b>	<p><b>Interactions between gas and electricity networks</b></p> <p>1) Medium term (2020) GB gas and electricity network studies:</p> <ul style="list-style-type: none"> <li>a) Evaluation of the robustness of the GB network to withstand high impact events</li> <li>b) Gas storage capacity adequacy</li> </ul> <p>2) What incentives are needed to encourage investment in large scale gas storage facilities: Evidence based evaluation</p> <p>3) Analysis of the gas and electricity distribution system to allow investigation of scenarios depicting a proliferation of distributed generation</p> <p><b>Development of UK-Electricity Infrastructure</b></p> <p>Alternative UK generation system expansion plans, based on detailed UK generation model</p> <p>Sensitivity analyses of generation plans subject to security of supply, fuel costs, investment costs of new plants, discount rate, and environmental constraints</p> <p>Documentation of methodological approach and key results</p> <p><b>Energy infrastructure: Regulatory &amp; policy issues</b></p> <p>Finalise journal articles on IFI/RPZs/distribution networks and innovation</p>	

	<p>Finish offshore wind paper</p> <p>Work on UKERC micro-generation project – complete draft of policy and regulation paper</p>	
<b>Outputs</b>	<p><b>Interactions between gas and electricity networks</b></p> <p>Report and Journal paper on the medium term gas and electricity network (July/August)</p> <p>Report on incentives to encourage investment in gas storage facilities (September)</p> <p>Report and journal paper on gas/electricity distribution system (December)</p> <p>Paper/presentation for the 6<sup>th</sup> conference on Applied Infrastructure Research, Berlin</p> <p><b>Development of UK-Electricity Infrastructure</b></p> <p>Alternative UK generation system expansion plans Based on detailed UK generation model</p> <p>Sensitivity analyses of generation plans subject to security of supply, fuel costs, investment costs of new plants, discount rate, and environmental constraints</p> <p>Report and journal paper on the developed generation expansion plans</p>	

## Materials for Advanced Energy Systems

	Planned	Actual
<b>January – June 2007</b>		
<b>Work carried out</b>	<p>Most of the activity carried out under this theme is pure and applied scientific research. The theme has been involved in a number of activities, both national and international to promote energy materials.</p>	<p>The work will be split down into the main areas of current activity</p> <p><b>(1) Materials for the Hydrogen Economy.</b></p> <p><b>(a) Hydrogen storage:</b> Work continues in preparing metal-organic frameworks as materials for potential hydrogen storage. Several of these are now in hand and full characterisation is being undertaken in the Materials and Chemical Engineering Departments at Imperial. Characterisation of the hydrogen uptake capacity of the framework materials is now underway in collaboration with Drs Book and Walton at the University of Birmingham. Initial results are encouraging and one well-characterised material has been found to take up 1.2% hydrogen under 8 atm pressure. Further studies on this compound to establish reversibility etc. are ongoing. Several new crystal structures of previously</p>

		<p>uncharacterised compounds show that these materials are also porous and these will also be studied further.</p> <p><b>(b) Hydrogen production:</b> Work continues to develop intermediate temperature electrolysis cells from both oxygen ion and protonic conductors for the utilisation of waste industrial heat.</p> <p><b>(2) Materials for PVs:</b> Considerable progress has been achieved in both the experimental and theoretical study of organic solar cell materials, including progress towards the development of gravure printing of organic cells onto flexible substrates.</p> <p><b>(3) Nuclear materials:</b> The simulation of materials for application in high radiation fluxes continues. Studies have just been completed on defect clustering in spinel based materials</p> <p><b>(4) Materials for CCS systems:</b> Oxygen separation membranes are one component of an integrated CCS system. Under this heading we have recently completed simulations of oxygen transport in layered perovskite materials, suitable as separation membranes. Experimental work on ceramic composite materials have been initiated to examine their suitability as membrane materials.</p>
<b>Outputs</b>	<p>Continued input into Mats UK roadmapping exercise</p> <p>Meeting on Accelerated Materials Discovery</p>	<p><b>Roadmapping:</b></p> <p>JK is member of the Steering committee of the DTI Mats UK Energy Materials working group. This group is aiming to deliver a roadmap for UK energy materials by late July.</p> <p>The PV group has continued roadmapping contact with David Infield, Future Sources of Energy theme</p> <p><b>Publications:</b></p> <ol style="list-style-type: none"> <li>1) Defect processes in <math>\text{MgAl}_2\text{O}_4</math> spinels. J.A.Ball, S.T.Murphy, R.W.Grimes, D.Bacorisen, R.Smith, B.P.Uberuaga, K.E.Sickafus. Solid State Sciences in press (2007)</li> <li>2) Dalton Transactions, "Framework Materials Assembled From Magnesium Carboxylate Building Units", R. P. Davies, R. J. Less, P. D. Lickiss, and A. J. P. White, pp. 2528-2535, 2007.</li> <li>3) Kilner, J.A., "Optimisation of oxygen ion transport in materials for ceramic membrane devices". Faraday Discussions, 2007. <b>134</b>: p. 9-15.</li> <li>4) Rossiny J and Kilner J.A. "Characterisation of Combinatorial libraries of Perovskite Materials for SOFC cathode Applications",</li> </ol>

		<p>Proc SOFC 10, ECS transactions 7, 1005-1013, 2007</p> <p><b>A major achievement</b> this last 6months was the organisation of a meeting on "Accelerated Materials Discovery for Energy Storage and Conversion Devices" held in conjunction with the Meeting Place in Oxford on the 2<sup>nd</sup>-4<sup>th</sup> of April. The meeting was co sponsored by the IEA AHGSET group and the Institute of Materials, Energy Materials Group. 75 participants from 11 countries participated together with a number of members from the relevant UK Supergen programme areas. The presentations given at the meeting are on the UKERC website</p> <p><b>International collaboration</b> is always a major part of any scientific programme and each individual part of the theme has its developed collaborative portfolio. One overarching activity has been the organisation of a workshop in Bangkok to promote ties between South East Asia and the UK activity in Fuel Cells represented by Supergen and UKERC FSE. The workshop was organised by JK in conjunction with MTEC in Bangkok and supported by the FCO in Singapore. As a result of the meeting the FCO initiated a competitive bid process for SE Asian scientist to visit the UK to discuss future collaboration in the area of fuel cells.</p>
<b>July – December 2007</b>		
<b>Activities</b>	<p>Continuing research activity from the theme with accelerated progress as the experimental programmes mature.</p> <p>Following discussion at the Annual Assembly discussions will take place with the Environmental Sustainability theme on the environmental impact of new materials for energy.</p>	
<b>Outputs</b>	<p>Journal publications will remain as the standard output from the theme.</p> <p>Multiple presentations at several major international conferences.</p> <p>A key task to be completed is a conference report for the Accelerated Materials Discovery Meeting for publication by UKERC</p>	

## Future Sources of Energy

	Planned	Actual
<b>January – June 2007</b>		
<b>Work carried out</b>	<p>FSE operates to plans, but until now they were have not been recorded in an activity report of this form. Generally they were to complete the Landscape Documents and Roadmaps and to launch three cross-cutting projects contributing to the integrated research programmes. This was in addition to the normal level of networking, capacity building and dissemination activities established prior to that.</p>	<p><b>Bioenergy:</b> Landscape complete and awaiting peer review. Appraisal of new roadmaps for Bioenergy from EU, USA, Canada and others on-going. Roadmapping – large consultative meeting with the community now complete, draft release planned for summer 2007, following further consultation to capture missing expertise at our Meeting Place event.</p> <p><b>Carbon Management:</b> Feedback from UKERC received on Research Atlas. Roadmap underway.</p> <p><b>Fuel Cells:</b> Landscape complete. No roadmap to be developed</p> <p><b>Photovoltaics:</b> Response to peer review comments on landscape completed. Roadmap undergoing peer review</p> <p><b>Wave and Tidal Power:</b> Landscape complete. Roadmapping underway. Meeting held at Oxford to review current status of UKERC Marine Roadmap and discuss a framework for an International Road Map for Marine Renewables; agreed that UKERC will be the custodian of the International Roadmap. Feedback from peer review of landscape has been received.</p> <p><b>Fission and Fusion:</b> Landscapes complete. No Fusion roadmap to be developed. Fission roadmap underway.</p> <p><b>Life Cycle Analysis</b> research underway with Carbon Management, Fission, Bioenergy and Marine. Literature survey nearing completion.</p> <p><b>Learning rates and learning effects</b> work linking Marine, PV, Bioenergy, Fission and Fusion has progressed. Research outline and timeline submitted to Co-Directors. Technology matrices and internal briefing notes are complete. New RA at Edinburgh recruited to work on marine learning rates and engage with marine developers in this work. Meetings have started.</p> <p><b>Micro-generation</b> project timeline and plan agreed and work is underway to integrate Demand Management, PV and Fuel Cells in the domestic environment.</p>
<b>Outputs</b>	<p>These planned activities have been largely completed, as detailed opposite.</p>	<p><b>Landscapes</b> Bioenergy, Marine, PV, Fusion, Fission, Fuel Cells and Carbon Management complete or nearing completion.</p> <p><b>Roadmaps</b> Bioenergy, Marine, Fission, and Carbon Management underway. PV posted for peer-review.</p> <p><b>Publications</b></p>

		<p>Winskel M 'Marine energy innovation in the UK energy system: financial capital, social capital and interactive learning' accepted for publication in <i>International Journal of Global Energy Issues</i></p> <p>Street NR, Skogstrom O, Sjodin A, Tucker J, Rodriguez-acosta M, Nilsson P, Jansson S, Taylor G. 'The genetics and genomics of drought response in Populus', in <i>Plant Journal</i>, 48, 321.</p> <p>Sims REH, Hastings Schlamadinger AB, Taylor G &amp; Smith P, 'Energy Crops: Current Status and Future Prospects' in <i>Global Change Biology</i>, 12, 1365.</p> <p>Liberloo, M Calfapietra C, Lukac M, Godbold D, Lou Z-B, Polle A, Hoosbeck MS, Kull O, Marek M, Raines C, Taylor G, Scarascia-Mugnozza G, Ceulemans R, 'Woody biomass production during second rotation of a bioenergy Populus plantation increases in a future high CO<sub>2</sub> world' in <i>Global Change Biology</i> 12: 1094-1106.</p> <p>Haszeldine, RS, Invited chapter for International Risk Governance Council '<i>Regulation for CCS beneath the UK offshore and onshore: deep geological storage and sequestration of CO<sub>2</sub></i>' Published by IRGC as one of six articles from around the continents</p> <p>Howarth, P "Frontiers in Particle Science and Technology vol 2", ISBN 978-1-905217-23-6</p> <p>Mueller, M A, Polinder H &amp; Baker N 'Current and Novel Electrical Generator Technology for Wave Energy Converters', Invited paper at IEEE International Conference on Electrical Machines &amp; Drives, May 2007 in Turkey.</p> <p>Shek JKH, Macpherson DE, Mueller MA &amp; Xiang J, 'Reaction Force Control of a Linear Generator for Direct Drive Wave Energy Conversion', IET Renew. Power. Gener., Vol1, No. 1, March 2007.</p> <p><b>UK engagement</b>  Arranged, hosted or attended around 30 visits or meetings in UK to develop research in FSE or publicise UKERC and its aims and outputs. CCS advice briefing paper to Scottish Executive (Parliament). UKERC hosted the Bioenergy research community for a one-day joint meeting of SUPERGEN Bioenergy, RELU Bioenergy, RELU Biogas and TSEC-BIOSYS. Proposal submitted to BBSRC for funding to make this an annual event.</p> <p><b>International engagement</b>  Participated in International Risk Governance Council, Washington, to evolve of a regulatory framework for CCS.</p> <p>Hosting visitors/interns on behalf of UKERC and universities from: China, India, New Zealand, Russia, Japan, USA, Singapore.</p>
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		<p>Meeting with Idaho National in UK to discuss collaborative links on GNEP.</p> <p>N Brandon appointed as the OSI Focal point in Energy with China, working with Nigel Birch in China.</p> <p>Visit to Tsinghau University, to discuss High temperature reactor knowledge.</p> <p>Imperial College engagement with US DoE on Nuclear Energy strategy.</p> <p>Brandon and Wallace visited Ghuangzhou Institute for Energy Conversion in March and presented on UKERC and FSE theme activities.</p> <p>Infield and Wallace visited Beijing in June and presented to MOST on UKERC and PV/Marine activities.</p> <p>Wallace then visited Dalian University of Technology and made similar presentations.</p> <p>Infield and Wallace hosted inward mission of Chinese Academy of Engineers in June and presented work of UKERC and FSE.</p> <p>Brandon invited speakers on the subject of UK fuel cells research at an FCO event in Tokyo in February.</p> <p>Mueller visited and presented on UKERC and marine mapping at Stellenbosch and Witswatersand Universities RSA.</p>
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#### July – December 2007

<b>Activities</b>	<p><b>Landscapes:</b> Re-appraisal and revision as necessary around December.</p> <p><b>Roadmaps:</b> Work will continue on the draft produced for PV and to produce draft for peer review in BioEnergy, Marine, CCS and Fission.</p> <p>Three integrating projects are underway, joint with Environmental Sustainability.</p> <p><b>Micro-generation:</b> The aim of this research is to assess the suitability of various types of micro-generation technologies for application in domestic buildings. A multidisciplinary approach has been adopted, drawing from expertise in energy policy, behavioural aspects of energy use, energy systems modelling and experimentation and demonstration.</p> <p><b>Learning rates and learning effects:</b> The aim of this research is to explore the circumstances, effects, parameters and consequences of learning rates and learning effects on the movement of existing and new renewable energy technologies down the innovation chain from fundamental R&amp;D to deployment. Specifically, the work will consider Marine, Fusion, Fission, PV and Bioenergy, and will be expanded to include CCS. The work will interact with the Energy Systems Markal model and will derive useful input from their scenario modelling. A PhD student has been recruited to work on learning rates at Edinburgh and will contribute to the group's activities.</p> <p><b>Life Cycle Analysis:</b> David Howard will report on this.</p>	
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<b>Outputs</b>	<p>Serviced <b>landscapes</b> by December. Draft/peer reviewed <b>roadmaps</b> for BioEnergy, Marine, CCS and Fission by December.</p> <p><b>Bioenergy</b> The landscape is being developed into a document suitable for submission to Biomass and Bioenergy as a brief review of current UK activity and directions for future research priority. A new PhD studentship on 'Improved efficiency of bioethanol production from poplar lignocellulose feedstock' is being partially funded by UKERC with majority funds from 'The Porter Alliance' at Imperial College of which GT is a partner. This will be a high profile piece of discipline based research to badge as UKERC, FSE.</p> <p><b>Micro-generation</b> The meta-analysis rationale, procedures and results will be complete and written as a draft paper for publication. The numerical modelling environment will be agreed, documented and implemented across partners, harmonised for data exchange. The experimental design and methodology for the domestic CHP rig at Imperial will be agreed documented and tested by partners there and at Birmingham and Loughborough.</p> <p><b>Learning rates and learning effects</b> Literature review complete and overarching working paper will be submitted to Energy Policy, Renewable Energy or equivalent for publication by December. Data exchange complete with Markal model and scenario outputs received for consideration, prior to next stages of engagement with technology communities.</p>	
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## Demand Reduction

	Planned	Actual
<b>January – June 2007</b>		
<b>Work carried out</b>	<p><b>Distributional team:</b></p> <ul style="list-style-type: none"> <li>- Research for Scoping Study on PCA Trial</li> <li>- Develop imeasure home version 2.0</li> <li>- ESRC Social Science Week</li> <li>- Help organise a one-day workshop - Commodifying Carbon: The Ethics of Markets in Nature</li> <li>- Attend ECEEE</li> <li>- Participate in RSA Workshop on PCA &amp; Transport</li> </ul>	<p><b>Distributional team:</b></p> <ul style="list-style-type: none"> <li>- Several workshops, visits and research for Scoping Study on PCA Trial</li> <li>- Developed imeasure home version 2.0</li> <li>- TF was Co-Panel leader for 'Dynamics of Consumption' at ECEEE - choosing, editing papers and co-chairing panel</li> <li>- Ran workshops for 6th Formers in 3 Oxfordshire secondary schools. Part of ESRC Social Science week</li> <li>- presentations to Bath University MSc group</li> <li>- Helped organise a one-day workshop to be co-hosted with Philosophy Dept (Biosciences group) in July - Commodifying Carbon: The Ethics of Markets in Nature.</li> <li>- Participated in RSA Workshop on PCA &amp; Transport</li> </ul>

	<p><b>Transport team:</b></p> <ul style="list-style-type: none"> <li>- Research on individual transport policy instruments for IMPACT</li> <li>- Research on cost-effectiveness of carbon abatement in the transport sector.</li> <li>- Develop UK Transport Carbon Model (UKTCM)</li> <li>- Arranging/ attending meetings and giving presentations as required</li> </ul> <p><b>Data team:</b></p> <ul style="list-style-type: none"> <li>- Develop imeasure</li> <li>- Liaise with Markal team</li> <li>- Analysis of various data sets (eg EHCS, NW London) to derive inputs to different models</li> </ul> <p><b>Market transformation team:</b></p> <ul style="list-style-type: none"> <li>- initial research into transport and market transformation</li> <li>- contributions to Tim Foxon book on learning curves</li> </ul> <p><b>Brenda Boardman:</b></p> <ul style="list-style-type: none"> <li>- Finalise 'Towards 40% everything' report</li> <li>- Progress with Demand Reduction contribution to integration scenarios</li> </ul> <p><b>Industry team: TBC</b></p>	<p><b>Transport team:</b></p> <ul style="list-style-type: none"> <li>- Continuing to progress with individual transport policy instruments for IMPACT</li> <li>- Researching cost-effectiveness of carbon abatement in the transport sector</li> <li>- Meetings with Treasury and Department for Transport</li> <li>- Attended RSA event on pcas and Commission for Integrated Transport Working Group on Transport and Climate Change</li> <li>- Major developments with UKTCM</li> </ul> <p><b>Data team:</b></p> <ul style="list-style-type: none"> <li>- imeasure version 2.0 complete, negotiations over commercialisation</li> <li>- analysis of imeasure results</li> <li>- several meetings with Markal team, provision of Demand Reduction housing and appliance data for inclusion in Markal</li> </ul> <p><b>Market transformation team:</b></p> <ul style="list-style-type: none"> <li>- Completed chapter for Tim Foxon book, MH and BB</li> <li>- First draft of transport and market transformation paper</li> <li>- Joined Imperial, Loughborough, etc on integrating study for UKERC on micro-generation. Recently, handed over to Chris Jardine, at ECI, to link with SuperGen study on highly distributed generation</li> </ul> <p><b>Brenda Boardman:</b></p> <ul style="list-style-type: none"> <li>- 'towards 40% lifestyle' report still unfinished</li> <li>- Continuing discussions on scenarios</li> <li>- Researched carbon labelling and effects on industry, retailers and consumers, with support from Tesco</li> <li>- Held two workshop and symposium on carbon labelling, co-hosted by UKERC and Tesco</li> <li>- Member of EDF's Sustainable Development Panel</li> <li>- Presentation at ECEEE on carbon labelling</li> <li>- Supported work on pca trialling and attended 3 workshops</li> <li>- 12 meetings / presentations, including with Earth Charter, RCEP, SDC, Joint Committee on Climate Change Bill</li> </ul> <p><b>Industry team: TBC</b></p>
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<b>Outputs:</b>	<p><b>Distributional team:</b></p> <ul style="list-style-type: none"> <li>- Write a report on PCA trialling</li> <li>- Give PCA presentations</li> <li>- Piloting imeasure home 2.0</li> <li>- Writing conference paper on Internet tool &amp; behaviour change</li> <li>- Organise Challenging Behaviour Brown Bag lunch series</li> </ul> <p><b>Transport team</b></p> <ul style="list-style-type: none"> <li>- journal publications</li> <li>- IMPACT policies</li> <li>- Briefing note for Meeting Place event</li> </ul> <p><b>Market Transformation team:</b> TBC</p>	<p><b>Distributional team:</b></p> <ul style="list-style-type: none"> <li>- CB wrote and presented ECEEE conference paper on Internet tools for behaviour change</li> <li>- drafting PCA trialling report</li> <li>- Gave 12 presentations (3 Masters level, Bath, Oxford &amp; UCL); Texas</li> <li>- imeasure home 2.0 is completed and is being commercialised through ISIS (Oxford Innovations).</li> <li>- Organised 5 Challenging Behaviour Brown Bag series since January.</li> </ul> <p><b>Transport team:</b></p> <ul style="list-style-type: none"> <li>- Paper submitted and accepted to AREA 'Priorities, policies and timescales: geography and the delivery of emissions reductions in the UK transport sector'</li> <li>- ESRC Festival of Science Event – Film 'The Great Aberdeen Transport Swap'</li> <li>- 'Transport and the Global picture' presented at the Scottish Executive Sustainable Transport seminar</li> <li>- Article for Transport Times on pcas</li> <li>- Article for Parliamentary Brief on UK Transport Policy</li> <li>- Media coverage – local press about 'Transport Swap'; local press about 'budget 2007'; German public radio about speed limits (article and reference to UKERC also in Der Spiegel)</li> </ul> <p><b>Market transformation team:</b></p> <ul style="list-style-type: none"> <li>- two poster papers at ECEEE on demand reduction in domestic and non-domestic buildings, shared with BMT</li> <li>- Chapter for Tim Foxon book</li> </ul> <p><b>Industry team (in press or online in last 6 months):</b> Hammond, GP and AB Winnett, 2006. 'Interdisciplinary perspectives on environmental appraisal and valuation techniques', <i>Proc. Instn Civil. Engrs: Waste and Resource Management</i>, <b>159</b> (3): 117-130 [<a href="https://doi.org/10.1806/warm.2006.159.3.117">DOI: 10.1806/warm.2006.159.3.117</a>].</p> <p>Dyer, CH, GP Hammond, CI Jones and RC McKenna, 2006. 'State of Science Review: Enabling Technologies for Demand Management - Industrial Energy Usage', Office of Science and Innovation (Foresight and Horizon Scanning Centre), DTI, London, 23pp [<a href="http://www.foresight.gov.uk/HORIZON_SCANNING_CENTRE/Energy/PDF/en">http://www.foresight.gov.uk/HORIZON_SCANNING_CENTRE/Energy/PDF/en</a>]</p>
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		<p><a href="#">abling technologies for demand management industrial energy usage.pdf</a>].</p> <p>Grubbström, RW, GP Hammond, SD Probert and APS Reis (eds), 2007. 'Industrial energy-analysis and management: a European perspective', <i>Applied Energy</i>, <b>84</b> (7-8), 671-674 [DOI: <a href="#">10.1016/j.apenergy.2007.01.001</a>] – guest editorial for a special issue.</p> <p>Hammond, GP, 2007. 'Industrial energy analysis, thermodynamics and sustainability (In memoriam: Willem van Gool)', <i>Applied Energy</i>, <b>84</b> (7-8): 675-700 [DOI: <a href="#">10.1016/j.apenergy.2007.01.022</a>] – invited contribution to the above special issue.</p> <p>Hammond, GP, 2007. 'Energy and sustainability in a complex world: reflections on the ideas of Howard T. Odum', <i>International Journal of Energy Research</i> [published online 15 May, 2007; DOI: <a href="#">10.1002/er.1323</a>] – invited contribution to a Special Edition on 'Green Energy', based on the text of a Keynote Lecture presented at the '2<sup>nd</sup> International Green Energy Conference' (IGEC-2). UOIT, Oshawa, Ontario, Canada, 25-29 June 2006.</p> <p>Hammond, GP and SS Ondo Akwe, 2007. 'Thermodynamic and related analysis of natural gas combined cycle power plants with and without carbon sequestration', <i>International Journal of Energy Research</i> [published online 29 May, 2007; DOI: <a href="#">10.1002/er.1328</a>] – another invited contribution to the Special Edition on 'Green Energy'.</p> <p>Dyer, CH, GP Hammond and RC McKenna, 2007. 'Engineering sustainability: energy efficiency, thermodynamic analysis and the industrial sector', In Proc. '15<sup>th</sup> International Conference on Thermal Engineering and Thermogrammetry' (THERMO), Budapest, Hungary, 27-29<sup>th</sup></p> <p><b>Brenda Boardman:</b></p> <ul style="list-style-type: none"> <li>- paper in Building Research and Information:</li> <li>- paper in press, Energy Policy: 'Electricity Disclosure – the troubled birth of a new policy'</li> <li>- Interview on the Money Programme, Green High Street, 28</li> </ul>
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		<p>June</p> <p>Russell McKenna (UKERC Interdisciplinary Research Student based at Oxford) was also the runner up in the IEMA Student Essay Awards 2007. This was announced at the end of May. Russell received £150 cash prize and enrolment on an Environmental Management learning module here in Bath, leading to IEMA Associate Membership.</p>
July – December 2007		
Activities	<p><b>All:</b></p> <ul style="list-style-type: none"> <li>- UKERC Annual Assembly</li> <li>- Arranging / attending meetings and giving presentations as required</li> <li>- Media interviews</li> <li>- Networking</li> <li>- Contribute to the scenario and integration project</li> </ul> <p><b>Distributional team:</b></p> <ul style="list-style-type: none"> <li>- Complete PCA Trialling Report and disseminate</li> <li>- seek funding for trial</li> <li>- commence the comparative analysis of distributional effects of taxation vs pca</li> <li>- Develop imeasure home version 3.0</li> <li>- Develop prototype of imeasure business</li> <li>- Participate in Commodifying Carbon Workshop</li> </ul> <p><b>Transport team:</b></p> <ul style="list-style-type: none"> <li>- Research on individual transport policy instruments for IMPACT</li> <li>- Research on cost-effectiveness of carbon abatement in the transport sector, meetings with Treasury and DfT</li> <li>- Continue to develop UKTCM and scenario building</li> <li>- Liaise with PSI, so UKTCM and Markal share common data, as much as possible</li> <li>- Co-editor of <i>Energy Efficiency</i>, new journal from Springer</li> </ul> <p><b>Data team:</b></p> <ul style="list-style-type: none"> <li>- Code imeasure to pre-analyse results</li> <li>- Develop prototype of imeasure business</li> <li>- Develop the modelling of all energy use, with outputs from UKDCM, UKNDCM, UKTCM</li> <li>- Liaise with PSI, to ensure consistency between DR and Markal</li> </ul> <p><b>Micro-generation team:</b></p> <ul style="list-style-type: none"> <li>- contribute to the micro-gen integration theme</li> <li>- research into the costs of micro-generation and new policy initiatives to increase take-up in existing homes</li> </ul> <p><b>Brenda Boardman:</b></p> <ul style="list-style-type: none"> <li>- edit team reports, eg on PCA trial</li> </ul>	

	<ul style="list-style-type: none"> <li>- support development of scenarios</li> </ul> <p><b>New team leader:</b></p> <ul style="list-style-type: none"> <li>- liaise with HQ over the production of scenarios</li> </ul>	
<b>Outputs</b>	<p><b>Distributional team:</b></p> <ul style="list-style-type: none"> <li>- Complete and disseminate PCA Trialling Report</li> <li>- Make imeasure version 3.0 publicly available</li> <li>- Test imeasure business (eg w/ Music Industry, SMEs)</li> <li>- Detailed notes on aspects of pcas (choice of: experience of CRAGs, children's allocation, frequency of issue)</li> <li>- Working paper on first results of carbon taxation vs pca</li> <li>- convert ECEEE paper on carbon calculators into a journal paper</li> <li>- Overview of pca, journal paper</li> </ul> <p><b>Transport team:</b></p> <ul style="list-style-type: none"> <li>- IMPACT – live on web by September and continual updating</li> <li>- Meeting Place event / paper on cost of abating carbon in the transport sector</li> <li>- Support MP event on Tourism and Aviation</li> <li>- Joint paper on the treatment of transport in Markal</li> <li>- Update transport research atlas</li> <li>- Papers on consumer travel patterns for Energy Policy and Transport Policy</li> <li>- Presentations: Natural History Museum Student Summit, July (Greening Cities); Steer Davis Gleave: Transport and Climate Change, October</li> </ul> <p><b>Data team:</b></p> <ul style="list-style-type: none"> <li>- commercialisation of imeasure home</li> <li>- develop prototype of imeasure business and test with sample SMEs and music industry</li> <li>- agreed structure for UK energy use and carbon model</li> </ul> <p><b>Market transformation team</b></p> <ul style="list-style-type: none"> <li>- further research into transport and MT – draft paper</li> <li>- update Buildings atlas</li> </ul> <p><b>Micro-generation:</b></p> <ul style="list-style-type: none"> <li>- Contribute to integration study report</li> <li>- Paper on the changing costs of micro-generation technologies</li> </ul> <p><b>Industry team:</b></p> <p><b>Brenda Boardman:</b></p> <p>Complete 'Towards 40% lifestyle'</p> <ul style="list-style-type: none"> <li>- Presentation to Natural History Museum, Student Summit, July (Greening Cities);</li> <li>- Sit on Panel at Museum of Rural Living, Reading</li> </ul>	

## Environmental Sustainability

	Planned	Actual
January – June 2007		
Work carried out	Activities had not been planned in 6 monthly reporting periods, so the reports describe the completion of activities carried out through until now.	<p>ES work is predominantly carried out through topics with details below:</p> <p><b>Bioenergy</b> A new member of staff (Rebecca Rowe) has been appointed to replace Nathaniel Street. A Bioenergy meeting for UK research community was hosted in Oxford, April 2007. The composition of a roadmap for Bioenergy has been defined.</p> <p><b>Offshore</b> Contributed to landscape and route-map. Participated in integrating project discussions. Collaborated on actions agreed.</p> <p><b>Transport</b> Transferred information from Kathy Hodder and Susan Brown who have left. Extended the atmospheric emissions content of the research landscape.</p> <p><b>Carbon Capture &amp; Storage</b> Research Atlas contributions. Discussions on CCS costs with Markal modellers</p> <p><b>Nuclear</b> Reviewed research landscapes for Fission; Identified relevant research expenditure on environmental issues; Drafted modifications.</p> <p><b>General</b> Individual topics continued and completed specific tasks, but all participated in planned activities to facilitate stronger integration both with the theme and between themes. Regular joint meetings with FSE are scheduled. Integrating projects with FSE have been set up (ES is leading one looking at Life Cycle Assessment LCA) The theme also contributed to wider UKERC activities (PhD selection panel, Summer School, Integrating Project meetings, etc.)</p> <p><b>Life Cycle Assessment</b> A project timeline and plan has been discussed and agreed and work is underway. We are looking to assess the importance, completeness and authority of different LCAs across different topics. Literature reviews in bioenergy, carbon capture &amp; storage, offshore and biofuels for transport have been performed.</p>
Outputs		<p><b>Landscapes</b> Issues pertaining to environmental sustainability of energy generation and use have been reviewed in the topics and material. Material has been integrated between topics (e.g. bioenergy and transport) and with material from other themes (predominantly FSE) and presented on the UKERC web site.</p> <p><b>Road maps</b> Existing and published road maps have been examined for their coverage of environmental impacts and constraints. Contributions to UKERC roadmaps in bioenergy, carbon management and</p>

		<p>marine energy have been made.</p> <p><b>Presentations and publications</b>  ES researchers attended and presented at a number of conferences and events in Britain and abroad. Gail Taylor was interviewed on German radio and on Meridian TV.  Meetings organised included a one day joint meeting of SUPERGEN Bioenergy, RELU Bioenergy, RELU Biogas and TSEC-BIOSYS was organised. A two day meeting in Oxford discussed the need for and form of a road map for bioenergy. Luke Reade attended meetings in Denmark and Norway discussing environmental issues associated with offshore power. Sam Holloway has made presentations in the Netherlands and India and is acting as an advisor to DTI at the OSPAR negotiations. Jeanette Whitaker presented at the SETAC conference in Portugal.</p> <p>Taylor <i>et al</i> (Submitted) Identifying potential environmental impacts of large scale deployment of dedicated bioenergy crops in the UK <i>Renewable and Sustainable Energy Reviews</i>  Holloway, S. 2007. Carbon Dioxide Capture and Geological Storage. <i>Phil. Trans. R. Soc. A</i>, <b>365</b>, 1095-1107</p>
<b>July – December 2007</b>		
<b>Activities</b>	<p><b>Landscapes</b>  Continue integration of material and revision of landscapes on UKERC web-site. Responses to peer review to be completed by December. Nuclear fission integrated and submitted by December, nuclear fusion drafted.</p> <p><b>Roadmaps</b>  Contributions to developing UKERC road maps (bioenergy, carbon management and marine) to continue.</p> <p><b>Integrating projects</b>  Three integrating projects are underway, joint with FSE, namely <i>Micro-generation</i>, <i>Learning rates and learning effects</i> and <i>Life Cycle Analysis</i>. Details of the first two are presented by Robin Wallace.</p> <p><b>Life Cycle Analysis</b>  The aim of this research is to assess the importance, completeness and authority of different LCAs across different topics. One of the ES objectives is to identify tools and approaches needed to make equitable and balanced assessments of the environmental implications of energy systems. Reviews will identify strengths and weaknesses along with issues not adequately addressed. LCA provides potential input into MARKAL, its value and usage will be discussed with the Energy Systems and Modelling (ESM) theme. Meetings between topic researchers and LCA experts are planned.</p>	



	<p><b>UKERC Whole System Model</b> A meeting with ESM is planned to discuss the data input for parameterising different scenarios and interpretation of output.</p> <p><b>Bilateral meetings</b> Following comments at the Annual Assembly, a bilateral between the Materials theme and ES is planned in Lancaster for late summer, early autumn. The Transport topic is organising meetings with Jillian Anable (Demand Reduction – Transport) and separately with Rob Gross (TPA) to discuss the transport question.</p>	
<b>Outputs</b>	<p><b>Bioenergy</b></p> <ol style="list-style-type: none"> <li>1. Submit a UKERC report on ‘Second generation bioenergy crops and the UK Environment’ – which is a distillation of the research paper submitted for peer review.</li> <li>2. Submit a ‘glossy’ Research Information Note’ on Yield of SRC forestry for bioenergy across England and Wales’</li> </ol> <p><b>Offshore</b></p> <ol style="list-style-type: none"> <li>1. Working paper on environmental sustainability research route map – to contribute to point 3 below</li> <li>2. Working paper on LCA of marine energy</li> <li>3. Organise environmental stakeholders workshop</li> </ol> <p><b>Carbon Capture and Storage</b></p> <ol style="list-style-type: none"> <li>1. Further work on LCA of carbon capture and storage, LCE of carbon capture and storage,</li> <li>2. Inputs on environmental sustainability of CCS to UKERC Markal modelling. modelling of leaks from CCS and impacts of leaks from CCS</li> </ol> <p><b>Transport</b></p> <ol style="list-style-type: none"> <li>1. Contribute to publication THE “RESILIENCE” OF AN ENERGY SYSTEM with Jim Skea and Paul Ekins. UKERC working paper leading to refereed publication.</li> </ol> <p><b>Life Cycle Analysis</b> A paper contrasting the use and completeness of LCA in different energy sectors will be drafted by December.</p>	

## Energy Systems and Modelling

	Planned	Actual
<b>January – June 2007</b>		
<b>Work carried out</b>	<ol style="list-style-type: none"> <li>1. UK MARKAL modelling: <ul style="list-style-type: none"> <li>• To build upon existing UK modelling expertise and to build a new version of the UK MARKAL model, including a major methodological extension (the MARKAL-Macro model)</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. UK MARKAL modelling: <ul style="list-style-type: none"> <li>• Following intensive data collection, programming, calibration and review processes the extended and fully revised new MARKAL model is now completed. <ul style="list-style-type: none"> <li>◦ Major updates include resource supply curves, full depiction of energy processes and fuel carriers, nuclear fuel, biomass and hydrogen energy chains, remote and</li> </ul> </li> </ul> </li> </ol>

	<ul style="list-style-type: none"> <li>• Significant analytical input into key energy policy debates.</li> <li>• Further research and academic applications</li> </ul> <p>2. UK macro-econometric modelling: Work at 4CMR in Cambridge on the UK MDM-E3 model is being coordinated with work on the related European (E3ME) and global (E3MG) macro-econometric models, funded by the FP6 ADAM project and the Tyndall Centre.</p> <ul style="list-style-type: none"> <li>• Extension of the MDM-E3 model to analyze incorporate "bottom-up" estimates of the effects of public policies on energy efficiency.</li> <li>• Module development (households, transport and energy) within MDM-E3</li> </ul>	<p>decentralized electricity grids, substantially greater detail in end-use sectors (industry, transport, residential, services and agriculture).</p> <ul style="list-style-type: none"> <li>• Major stakeholder engagement involved a range of bilateral reviews, three dedicated sectoral workshops, and a major model data and results event in June 2007</li> <li>• A comprehensive documentation effort was undertaken with all data sources, assumptions etc being made publicly available at <a href="http://www.ukerc.ac.uk/content/view/398/893">http://www.ukerc.ac.uk/content/view/398/893</a></li> <li>• A major methodological extension to incorporate a neoclassical macro-economic module (the MARKAL-Macro model) was successfully completed</li> <li>• A key analytical input into policy has been to quantify a range of low carbon scenarios as a key input and ongoing analysis for the UK 2007 Energy White Paper, published in May 2007. This has involved both the MARKAL and MARKAL-Macro models (see <a href="http://www.ukerc.ac.uk/content/view/406/604">http://www.ukerc.ac.uk/content/view/406/604</a> and <a href="http://www.dti.gov.uk/energy/whitepaper/page39534.html">http://www.dti.gov.uk/energy/whitepaper/page39534.html</a>).</li> <li>• A further application has been to quantify hydrogen infrastructure development via the SuperGen UKSHEC programme.</li> <li>• UK MARKAL is now being used to underpin the UKERC integrating scenario process focusing on energy security and carbon reduction goals.</li> <li>• Further, the UK model is contributing in an international modelling effort on low carbon societies (LCS) under a joint Japan-UK research programme designed to report to the 2008 Japanese G8 presidency</li> </ul> <p>2. UK macro-econometric modelling:</p> <ul style="list-style-type: none"> <li>• Work on model development within MDM-E3: <ul style="list-style-type: none"> <li>◦ The household energy demand sub-model has been extended to simulate household demand to 2010 on the 2005 Cambridge Econometrics projections. The sub-model includes 36 types of energy appliance and 14 types of insulation.</li> <li>◦ Data on energy use for the household energy sub-model for existing and new appliances has been gathered from a range of data sources including the English House Condition Survey and Family Expenditure Surveys.</li> <li>◦ Work is underway to update and implement an earlier transport energy sub-model. This approach enables a detailed examination of trends and policies affecting passenger demand, ownership rates and key technological characteristics.</li> <li>◦ Econometric estimation of both passenger and freight transport fuel economy has</li> </ul> </li> </ul>
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	<ul style="list-style-type: none"> <li>• Developing an energy technology model representing endogenous technological change and technology learning rates</li> <li>• The capacity for uncertainty analysis to be incorporated into the latest version of MDM-E3.</li> <li>• Significant analytical input into key energy policy debates.</li> <li>• Further research and academic applications</li> </ul> <p>3. Integration of top-down and bottom-up energy modelling approaches</p> <p>4. Networking and Co-ordination</p> <ul style="list-style-type: none"> <li>▪ To develop the coherence and capacity of UK energy research modelling</li> <li>▪ Deepen the interactions within the UK and with major international energy modelling groups</li> </ul>	<p>been completed.</p> <ul style="list-style-type: none"> <li>◦ An initial version of the energy technology model representing endogenous technological change and technology learning rates, has been incorporated into MDM-E3 to enable assessment of a wider range of renewable energy technology options.</li> </ul> <ul style="list-style-type: none"> <li>• The capacity for uncertainty analysis is being incorporated into the latest version of MDM-E3, to enable assessment of the robustness of scenarios to parameter uncertainty using Bayesian methods developed for the Tyndall CIAS work.</li> </ul> <p>3. Integration of top-down and bottom-up energy modelling approaches:</p> <ul style="list-style-type: none"> <li>• Development of the current MDM-E3 sub-models, as described above.</li> <li>• Completion and use in the 2007 Energy White Paper of the UK MARKAL-Macro, the version of MARKAL which is linked to a neoclassical growth model.</li> <li>• A co-ordinated review was undertaken of the papers in the 2006 Special Issue of the <i>Energy Journal</i> on 'Hybrid Modelling of Energy-Environment Policies: reconciling bottom-up and top-down'.</li> </ul> <p>4. Networking and Co-ordination</p> <ul style="list-style-type: none"> <li>• A regularly updated inventory of UK modelling research was fed into the UKERC Research Atlas.</li> <li>• The revised mapping on UK energy systems modelling expertise is available at: <a href="http://ukerc.rl.ac.uk/ERL001.html">http://ukerc.rl.ac.uk/ERL001.html</a></li> <li>• Two major international workshops on 'Innovation in energy systems', were held, with a book, co-edited by Dr Tim Foxon, is being produced based on the papers presented and discussions at the workshop.</li> <li>• ESM is the core organizer of an international energy modelling collaborative effort designed to quantify scenarios of low carbon societies (LCS). This involves 12 international modelling teams, with a heavy developing country focus. The output of this project will feed into the G8 Gleneagles dialogue when Japan holds the presidency in 2008 as well as in a special journal issue of Climate Policy.</li> <li>• Terry Barker served as a co-ordinating Lead Author (CLA) on climate change mitigation for the IPCC's Fourth Assessment Report which reported in May 2007</li> <li>• Strategic collaborations have been agreed with MARKAL modelling teams in the USA, Netherlands, Japan and India to share insights and workloads in developing, maintaining and improving the respective models.</li> </ul>
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		<ul style="list-style-type: none"> <li>Stakeholder relationships have been developed with a range of non-UKERC energy groups in order to tap into expert knowledge and to review the modelling work. These include the Carbon Trust, DTI, DfT, DEFRA, BRE, TSEC biomass, TSEC carbon capture, the various SuperGen consortia, SPRU, Imperial College, Dalton Institute, EON, UK, EDF Energy, other academic institutes and a number of energy consulting firms.</li> </ul>
<b>Outputs</b>	<p>1. UK MARKAL modelling:</p> <ul style="list-style-type: none"> <li>Preparation of working papers and documentation of MARKAL modelling assumptions</li> </ul> <p>2. UK Macro-econometric modelling:</p> <ul style="list-style-type: none"> <li>Preparation of journal papers and working papers</li> </ul>	<p>1. UK MARKAL modelling:</p> <ul style="list-style-type: none"> <li>Three working papers to explain the assumptions, scope and results of the new model with the aim to increase transparency were completed and are now available under the UKERC-ESM working paper series at: <a href="http://www.ukerc.ac.uk/content/view/29/5/592">http://www.ukerc.ac.uk/content/view/29/5/592</a></li> <li>Three working papers have been produced for the UKSHEC programme (see <a href="http://www.psi.org.uk/ukshec">http://www.psi.org.uk/ukshec</a>). These discuss modelling approaches to new hydrogen infrastructures, a more detailed assessment of MARKAL modelling of hydrogen and an initial quantification of the development of UKSHEC hydrogen visions in the UK through 2050.</li> <li>A range of low carbon scenarios have been produced for the UK 2007 Energy White Paper, involving both the MARKAL and MARKAL-Macro models (see <a href="http://www.ukerc.ac.uk/content/view/40/6/604">http://www.ukerc.ac.uk/content/view/40/6/604</a>)</li> <li>Strachan N., R. Kannan (2007), 'Quantifying technological and economic implications of long-term carbon reduction scenarios for the UK', presented at the 9<sup>th</sup> IAEE European Energy Conference in Florence in June 2007</li> <li>A series of subsequent Journal papers on long-term scenario modelling using the UK MARKAL models are being drafted</li> </ul> <p>2. UK macro-econometric modelling:</p> <ul style="list-style-type: none"> <li>Barker, T S, Ekins, P and Foxon, T J, 'The macroeconomic rebound effect and the UK economy', <i>Energy Policy</i> (to appear 2007/08).</li> <li>Barker, T S, Ekins, P and Foxon, T J (2007), 'Macroeconomic effects of efficiency policies for energy-intensive industries: the case of the UK Climate Change Agreements, 2000-2010', <i>Energy Economics</i>, special issue 'Modelling of industrial energy consumption' (to appear)</li> <li>Köhler, J, Barker, T, Pan, H, Agnolucci, P, Ekins, P, Foxon, T J, Anderson, D, Winne, S, Dewick, P, Miozzo, M and Green, K (2007), 'New Lessons for Technology Policy and Climate Change: Investment for Innovation', <i>Climate Policy</i> (to appear)</li> <li>Bonilla, D, T.J. Foxon (2007), 'Estimating demand for new car fuel economy in the UK 1970-2004 using a two-stage error correction</li> </ul>

		<p>model' presented at 9th IAAE European Conference, Florence</p> <ul style="list-style-type: none"> <li>Barker, Terry and Jonathan Rubin (2007), "Macroeconomic effects of climate policies for road transport: Efficiency agreements versus fuel taxation for the UK, 2000-2010" <i>Transportation Research Board of the National Academies</i> Conference, Washington D.C., January 2007, to be published in <i>Transportation Research Record</i></li> <li>Foxon, T J, and Pearson, P (2007), 'Towards Improved Policy Processes for Promoting Innovation in Renewable Electricity Technologies in the UK, <i>Energy Policy</i> Vol 35, No.3, pp 1539-1550</li> <li>Agnolucci, P and Bonilla, D, 'UK freight demand: its determinants and dynamic properties', submitted to <i>Journal of Transport Economics and Policy</i></li> <li>Bonilla, D and Foxon, T, 'The Demand for New Car Fuel Economy of Gasoline and Diesel in the UK'. submitted to <i>Journal of Transport Economics and Policy</i></li> <li>Barker, T, Jenkins, K, 'The domestic energy sub-model in MDM-E3', UKERC Working Paper</li> </ul>
	<p>3. Integration of top-down and bottom-up energy modelling approaches:</p> <ul style="list-style-type: none"> <li>Review of previous hybrid modelling approaches</li> </ul>	<p>3. Integration of top-down and bottom-up energy modelling approaches:</p> <ul style="list-style-type: none"> <li>Review of the papers in the 2006 Special Issue of the <i>Energy Journal</i> on 'Hybrid Modelling of Energy-Environment Policies: reconciling bottom-up and top-down'.</li> </ul>
<b>July – December 2007</b>		
<b>Activities</b>	<p>1. UK MARKAL modelling:</p> <ul style="list-style-type: none"> <li>Series of journal articles on long term energy system evolution</li> <li>Modelling of G8 modelling collaboration of modelling low carbon societies, including technology and behavioural change interactions</li> <li>Completion of model documentation</li> <li>Complementary projects on very deep CO2 reduction strategies, and on GIS modelling of energy infrastructures)</li> </ul> <p>2. UK macro-econometric modelling:</p> <ul style="list-style-type: none"> <li>Completion of transport and domestic energy sub-models and integration into MDM-E3 (end of August 2007)</li> <li>Completion of documentation and working papers for sub-models</li> <li>Incorporation of UK specific data into energy technology model in MDM-E3</li> <li>Revised version of energy technology model description</li> <li>Implementation of capacity for uncertainty analysis into MDM-E3</li> </ul> <p>3. Integration of top-down and bottom-up energy modelling approaches:</p> <ul style="list-style-type: none"> <li>Implementation of sub-models to make MDM-E3 a fully integrated, top-down/bottom-up model</li> <li>Write a paper on hybrid modelling approaches</li> </ul>	
<b>Outputs</b>	<p>1. UK MARKAL modelling:</p> <ul style="list-style-type: none"> <li>At least three Journal papers</li> <li>Input into the Japanese G8 presidency on low term low carbon societies</li> <li>Working paper on UK energy scenarios</li> <li>Working paper on UKERC integrating climate and security scenarios</li> </ul> <p>2. UK macro-econometric modelling:</p> <ul style="list-style-type: none"> <li>Working Paper on transport sub-model</li> <li>Revised version of energy technology model description</li> </ul>	

	3. Integration of top-down and bottom-up energy modelling approaches: <ul style="list-style-type: none"> <li>Paper on hybrid modelling approaches</li> </ul>
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## Meeting Place

	Planned	Actual
<b>January – June 2007</b> All Meeting Place activities planned were delivered.		
<b>Work carried out</b>	Aim to run an average of 2 events per month Organised a total of 12 activities, all in Oxford unless otherwise indicated: <ul style="list-style-type: none"> <li>23<sup>rd</sup>-24<sup>th</sup> January: A Framework for an International Marine Renewable Energy Roadmap, facilitated workshop</li> <li>8<sup>th</sup> March: Energy &amp; Equity workshop</li> <li>30<sup>th</sup> March: Environment Agency Energy Research Agenda, workshop</li> <li>2<sup>nd</sup>-4<sup>th</sup> April: Accelerated Materials Discovery for Energy Storage and Conversion Devices – an international conference in partnership with the IEA and the Institute of Materials, Minerals and Mining. 3-day large international workshop.</li> <li>11<sup>th</sup>-12<sup>th</sup> April: Sustainable hydrogen production: A role for fusion? workshop</li> <li>24<sup>th</sup> April: UKERC-RELUBioenergy Meeting, workshop</li> <li>25<sup>th</sup>-26<sup>th</sup> April: Bioenergy Research Roadmap, facilitated workshop</li> <li>1<sup>st</sup>-2<sup>nd</sup> May: CCS Road-mapping facilitated workshop (Edinburgh)</li> <li>3<sup>rd</sup>-4<sup>th</sup> May: Carbon Labelling Expert Roundtable (facilitated) – in collaboration with TESCO</li> <li>18<sup>th</sup> May: Carbon Labelling Symposium (London) – in collaboration with TESCO</li> <li>13<sup>th</sup> June: International Symposium “Achieving a Sustainable Low-Carbon Society” (London) – in collaboration with Defra, the Ministry of Environment in Japan, the Tyndall Centre, The Japanese Embassy and the National Institute of Environmental Studies (Japan)</li> <li>14<sup>th</sup>-15<sup>th</sup> June: International “expert workshop “Achieving a Sustainable Low-Carbon Society” (London) – in collaboration with Defra, the Ministry of Environment in Japan, the Tyndall Centre, The Japanese Embassy and the National Institute of Environmental Studies (Japan)</li> <li>25<sup>th</sup>-29<sup>th</sup> June: UKERC Summer School (Cambridge)</li> <li>27<sup>th</sup>-29<sup>th</sup> June: UKERC Annual Assembly (Cambridge)</li> </ul> <ul style="list-style-type: none"> <li>The mix of activities over the last 6 months has involved greater use of facilitation techniques. Facilitation can ensure much greater participant engagement and a higher quality output. The increasing use of facilitation techniques reflect the fact that a greater proportion of Meeting Place activities are research-focused delivering a more substantial research related output such as a technology research roadmap.</li> <li>For the first time, the Meeting Place has collaborated closely with industry (Tesco). The carbon labelling workshop and symposium were very successful activities, receiving very positive feedback from participants and a wide range of stakeholders. The activities enabled expert debate and wide stakeholder involvement on a very important, high-profile and contentious topic.</li> </ul>	

	<ul style="list-style-type: none"> <li>For the second time, the Meeting Place provided substantial intellectual and logistical support for a high-profile international expert workshop (Low Carbon Societies), the output of which will feed into the G8 decision-making process under the Japanese Presidency next year.</li> </ul>	
<b>Outputs</b>	<p>The Meeting Place aims to publish and disseminate workshop/meeting reports as soon as possible after the event. Very often the Meeting Place is dependent on the 'champions' of the activity. Thus the Meeting Place is very often not in control of when the reports are finalised. Several reports from activities in 2006 were published and disseminated in 2007 either for this latter reason or because the manager (maternity replacement) was overloaded. From November 2007, two co-managers have been in place which has solved this problem and enabled a general increase of activity.</p> <p>Planned: publication of Meeting Place brochures and banners; presentation of poster and paper at international conferences.</p>	<p>The following workshop reports were published in the first half of 2007:</p> <ul style="list-style-type: none"> <li>Carbon Neutrality and Carbon Offsets</li> <li>Place and Energy: Does Scale Matter?</li> <li>Improving Energy Efficiency in a New Europe: Leveraging the Kyoto Flexibility Mechanisms – past, present and future.</li> <li>Joint action to combat energy poverty in Europe: research and policy challenges</li> <li>Implementing Kyoto – does it all add up?</li> <li>A Framework for an International Marine Renewable Energy Roadmap</li> <li>Energy and Equity</li> <li>The Environment Agency and Energy: Future role, priorities, research requirements and collaboration.</li> <li>UKERC-RELU Bioenergy Meeting: Bringing together Research Council supported bioenergy teams.</li> <li>CCS Roadmapping</li> <li>Carbon Labelling: Report on Roundtable</li> <li>Carbon Labelling: Report on Symposium</li> <li>The contents for the book, 'Innovation for a Low Carbon Economy: Economic, Institutional and Management Approaches' were submitted to publishers Edward Elgar on 13<sup>th</sup> June 2007. This book is the output of a workshop series held March and Sept 2006.</li> </ul> <p>As part of the effort to raise the international profile of the Meeting Place, the following outputs were delivered:</p> <ul style="list-style-type: none"> <li>publication of Meeting Place brochure providing information about the Meeting Place and how</li> </ul>

		<p>interested parties can apply for support</p> <ul style="list-style-type: none"> <li>- production of two Meeting Place banners outlining purpose and info about the Meeting Place for display at events</li> <li>- presentation of an academic poster ("The UKERC Meeting Place: a new model for stimulating the energy debate") at the European Council for Energy Efficient Economy Summer Study (4-8<sup>th</sup> June), targeting an international audience of academic experts.</li> <li>- presentation of an academic paper (The UKERC Meeting Place: a transferable model for international energy research collaboration and networking?) at the Wessex Institute of Technology Conference, 20-22 June: Energy 2007 – The First International Conference on Energy and Sustainability.</li> </ul>
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#### July – December 2007

<b>Activities</b>	<p><b>Activities scheduled for the next 6 months:</b> Aim to run an average of 2 events per month</p> <p>Events scheduled so far:</p> <ul style="list-style-type: none"> <li>• 18<sup>th</sup>-19<sup>th</sup> July: SUPERGEN meeting</li> <li>• 19<sup>th</sup>-20<sup>th</sup> September: China/US/UK carbon capture and storage workshop</li> <li>• 25<sup>th</sup> September: Energy White Paper Seminar in collaboration with the BIEE</li> <li>• October: Agent Based Modelling in collaboration with the Environment Agency</li> <li>• Autumn: Aviation and economic aspects relating to tourism</li> <li>• Autumn: Transport and economics – questioning assumptions and figures</li> <li>• Autumn: Smart integrated metering for households in collaboration with the Sustainable Development Commission</li> <li>• 4<sup>th</sup>-5<sup>th</sup> December: Annual Energy Modelling Conference</li> </ul> <p><b>Further developing the Meeting Place:</b></p> <ul style="list-style-type: none"> <li>• Over the next 6 months the Meeting Place will distribute brochures within the UK and overseas to raise the profile of the Meeting Place among existing and new key partners e.g. International Energy Agency; European Commission; civil service departments of UK and international governments; international</li> </ul>	
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	<p>energy research institutes; universities with departments specialising in energy. This promotion will focus on increasing international activity, in particular high-profile workshops, research-focussed activities, and longer term visits.</p> <ul style="list-style-type: none"> <li>• Aim to better integrate Meeting Place with NERN and Research Atlas</li> <li>• Meeting Place to support UKERC integration initiatives as required.</li> <li>• Meeting Place to build on existing use of PC-conferencing, audio-conferencing and use of internet tools to share documents (e.g. Google Docs &amp; spreadsheets; Oxford University weblearn) for development of activities and to promote use across UKERC.</li> <li>• Build up existing effort to bring in non-energy experts from eg scientific/economic community to input on major energy issues.</li> </ul>	
<b>Outputs</b>	Continue to publish and disseminate activity outputs (e.g. reports) as soon as possible after the event.	

## Technology and Policy Assessment

	Planned	Actual
<b>January – June 2007</b>		
<b>Work carried out</b>	<ul style="list-style-type: none"> <li>– Complete Investment Decisions report and hold launch event.</li> <li>– Drafting of Rebound project summary reports and revisions to detailed working papers.</li> </ul>	<ul style="list-style-type: none"> <li>– See below.</li> <li>– Drafts of Summary Report of Rebound project complete, together with drafts of five Technical Reports and two Supplementary Notes</li> </ul>
<b>Outputs:</b>	<ul style="list-style-type: none"> <li>– Publish paper 'Renewables and the grid: understanding intermittency' in Proceedings of Institute of Civil Engineers (ICE), Energy journal.</li> <li>– Submit paper 'Intermittent renewable generation and the cost of maintaining power system reliability' to Institution of Engineering and Technology (IET) , Generation, Transmission and Distribution (GTD) journal.</li> </ul>	<ul style="list-style-type: none"> <li>– ICE paper published February 2007</li> <li>– Paper submitted to IET GTD and accepted subject to revisions. Revisions completed and submitted.</li> <li>– Chapter submitted, revisions and copy edits completed.</li> </ul>

	<ul style="list-style-type: none"> <li>– Submit chapter for forthcoming OU book 'Renewable Electricity and the Grid, the Challenge of Variability', based on Intermittency report.</li> <li>– Investment Decisions project report publication</li> <li>– Circulate Rebound project Summary Report for review and comment.</li> <li>– Results of Rebound project to be launched in September 2007</li> </ul>	<ul style="list-style-type: none"> <li>– 'Investment in electricity generation, the role of costs, incentives and risks' published and launched June 2007.</li> <li>– Investment decisions report findings presented to DTI energy white paper team, energy strategy group and energy markets group.</li> <li>– Investment decisions report findings presented to the DTI Renewables Advisory Board (RAB).</li> <li>– Investment decisions report findings presented to the Carbon Trust</li> <li>– 'Defining and measuring the rebound effect', presented at Policy Studies Institute, London, January 2007.</li> <li>– Paper: "The rebound effect: definitions, limitations and extensions", the accepted for publication by <i>Ecological Economics</i> journal</li> <li>– Editing a book on the rebound effect in collaboration with Horace Herring (Open University). To be published by Palgrave in 2008. (includes 3 chapters by Steve Sorrell)</li> <li>– Writing a chapter on the rebound effect for the International Handbook on the Economics of Energy (edited by Lester Hunt), to be published by Edward Elgar in 2008.</li> </ul>
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#### July – December 2007

<b>Activities</b>	<ul style="list-style-type: none"> <li>– Complete Rebound project summary report and all detailed working papers.</li> <li>– Meet with DTI team to discuss findings of the Investment Decisions report and prospects for further work related to UKERC recommendations.</li> <li>– Draft journal paper/s based on Investment Decisions report.</li> <li>– Initiate next TPA project – (working title) 'The efficacy of transport policy interventions.'</li> <li>– Define scope, form expert group, engage with collaborating organisations, begin review process.</li> <li>– Hold next Advisory Group meeting and identify TPA project/s to follow Rebound project.</li> </ul>	
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<b>Outputs</b>	<ul style="list-style-type: none"> <li>– Rebound project report publication and launch, scheduled for September 2007.</li> <li>– IET GTD Intermittency paper published.</li> <li>–</li> <li>– OU Book with UKERC Intermittency report chapter published.</li> </ul> <p>Meet with DTI to revisit findings of intermittency report in the light of EU 20% target (done)</p>	
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## Research Register

	Planned	Actual
<b>January – June 2007</b>		
<b>Work carried out</b>		<ul style="list-style-type: none"> <li>• Further development of the user interface of the Research register</li> <li>• Continued population of the Research Register with data from funding sources</li> </ul>
<b>Outputs</b>		<ul style="list-style-type: none"> <li>• As at 4 July 2007, the Research Register contains 741 grants (data sources include EPSRC, DTI, Carbon Trust, ESRC and Leverhulme Trust)</li> <li>• As at 4 July 2007 a total of 2177 EPSRC grants have been inspected and deemed not to be energy-relevant (all grants with a start date of 1 March 2006 or later have now been inspected).</li> <li>• On 11 May 2007 a new version of the Research Register was released : This provided summary stats at the end of each list of grants, and also a clearer interface to listing by energy category</li> <li>• On 26 June 2007 a further new version of the Research Register was launched to allow expenditure analysis by both calendar year and financial year</li> <li>• In June 2007 the first batch of NERC data was obtained and is currently being processed</li> <li>• As at 28 June 2007, 33076 pages of information had been accessed by users of the Research Register</li> </ul>
<b>July – December 2007</b>		
<b>Activities</b>	<p>Continued development of the user interface to the Research Register – specific tasks include :</p> <ul style="list-style-type: none"> <li>a) display of total project value, industrial partner, recognised partner details if the input data can be obtained</li> <li>b) downloadable summaries for input into Excel/Access</li> </ul> <p>Continuing the import of data into the Register</p> <p>Development of a specification to move the research landscape into www database format</p>	

	Consideration to creation of a Transport Policy database for the Demand Reduction Theme – progress depends on the speed at which a specification is agreed	
<b>Outputs</b>	The targets being that by 31/12/07 : a) the Register contains at least 1000 grants, b) PI's have been emailed and asked to check their grant entries and provide additional information, c) all grants funded by EPSRC with a start date of 1 Jan 2004 have been inspected for inclusion in the Register, d) Some NERC grants have been imported, e) the Register's user interface allows for summaries to be downloaded in a form suitable for import into Excel or Access (timing depends on when a detailed specification is agreed)	

## Energy Data Centre

	Planned	Actual
<b>January – June 2007</b>		
<b>Work carried out</b>		<ul style="list-style-type: none"> <li>– Further development of EDC data archive</li> <li>– Groundwork carried out for posting of data on EDC</li> </ul>
<b>Outputs:</b>		<ul style="list-style-type: none"> <li>– Initial metadata categories have been assigned and the first data with draft metadata entries posted on the EDC</li> <li>– Elexon data on electricity load profiles for standard user classes posted on EDC (with appropriate metadata and plot tool)</li> <li>– Sample data set on appliance energy consumption posted on EDC and contact made with Defra to discuss access to further data</li> <li>– Basic statistics on UK population and households posted on EDC</li> </ul>
<b>July – December 2007</b>		
<b>Activities</b>	<ul style="list-style-type: none"> <li>– Work to post the Energy Systems &amp; Modelling data on the EDC</li> <li>– Negotiate with Carbon Trust over access to identified data on degree-days and household energy consumption</li> <li>– Continue to develop metadata category list</li> <li>– Develop list of standard parameter names</li> </ul>	
<b>Outputs</b>	<ul style="list-style-type: none"> <li>– Select database for storage of (searchable) metadata</li> <li>– Enable access control for specified data sets ("My UKERC-EDC") when and if user(s) require this refinement</li> </ul>	