



**UKERC**

# **Report to Supervisory Board**

July – December 2007

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## Overview

UKERC has continued to make progress in the second half of 2007 with respect to both primary research and networking activities. Overall, the key highlights have been:

- a number of staff/organisational changes including a new leader for the Demand Reduction theme, and transfers of staff from PSI to Kings College London (Systems and Modelling), Warwick Business School to Exeter (Infrastructure and Supply) and from Manchester to Cardiff (Infrastructure and Supply)
- a continuing build-up of publication in the peer-reviewed literature from theme-level research
- substantial progress with the “integrating” UKERC Energy 2050 Project which has fostered interactions between themes and participating institutions;
- high visibility for UKERC work, especially the Technology and Policy Assessment function’s energy efficiency rebound effect report
- steady expansion, and considerable external use of, the Energy Research Atlas. Most of the material has now been through peer review.
- Continuing strong international links both with individual countries (especially China and India) and multilateral activities (FP7, IPCC)
- Intensified networking activity, notably with the appointment of National Energy Research Network manager and with the creation of SPARKS, the early career researchers’ network.

We have re-organised the report to the Supervisory Board somewhat since last time. The first section focuses on primary research activity including both the work of UKERC’s six individual themes and cross-thematic activity, notably the UKERC Energy 2050 Project. We have then grouped a number of our other activities – secondary research and networking – under the heading knowledge transfer reflecting an interest in this focus shown by the Research Councils at the last meeting. Finally, we look at communications issues more generally, international links and management/financial developments.

## **Primary Research**

### *Theme Highlights*

Themes have been continuing their research and networking programmes in accordance with their original plan and in parallel with the UKERC Energy 2050 programme.

Further information in any of the theme activities can be found in Appendix 1

**Energy Infrastructure and Supply** This period has seen excellent progress with the implementation of the gas and electricity expansion extension of the Combined Gas and Electricity Model (CGEN), that was populated with supply/demand and infrastructure plans up to 2020.

A good link between the WASP (electricity generation planning) and CGEN models has been established that investigates both the generation and transmission component of UK energy infrastructure development in an integrated mode. A framework for interaction between three key UKERC energy modelling tools (MARKAL/WASP/CGEN) has been established. The three models will be used in tandem as part of the UKERC Energy 2050 project.

On the regulatory side, a report on the incentives to encourage investment in large scale gas storage facilities will be completed by April 2008. The previous paper on Innovation Financial Incentives (IFIs) and Registered Power Zones (RPZs) is being turned into a UKERC working paper and a journal article. A paper on transmission has been broadened beyond offshore wind to consider a range of transmission issues, in particular the GB Queue and access for renewables, and the development of plans for transmission in the Western Isles. This theme is also contributing to the cross-cutting microgeneration project (see below).

**Materials for Advanced Energy Systems** Progress continues to be made in the areas of hydrogen storage, electrolysis for hydrogen production and advanced photovoltaics. Progress has been slower than expected in hydrogen storage with Dr Rataboul leaving to take up an academic position in France. However, several structural studies were carried out on the silsesquioxane molecules that were being used as models for the cores of metal organic frameworks in conjunction with Prof. D. Rankin and Dr. S. Masters at the University of Edinburgh. Several new compounds for hydrogen uptake studies have been prepared in collaboration with Dr Book at the University of Birmingham, obtaining our first lead compound, derived from picolinic acid, that absorbs about 1.2 weight % hydrogen even at the modest pressure of 2 atm.

In relation to electrolysis, in January 2008, two new setups will be built in the lab simultaneously, an on-line real time H<sub>2</sub> and O<sub>2</sub> evaluation system and a photoelectrochemical water splitting system using different bias to separate electrons and holes in semiconductor films. In March 2008, a four flash lamp system will be built to simulate the O<sub>2</sub> production process and find the key points which determined O<sub>2</sub> reaction rate.

For PV, we will begin in-house simulation of small-molecule film morphology and compare with existing methods -in collaboration with the University of Karlsruhe- and adapt new and faster quantum chemical software to electronic characterisation of film morphologies

**Future Sources of Energy** FSE is playing a major role in progressing cross-theme research activity, including UKERC Energy 2050, the microgeneration project and work on learning rates and technological innovation. This latter piece of work is being led by Dr Winskel .

It is also continuing to make the largest contribution to the development of the Energy Research Atlas, by updating Research Landscape documents and developing new UKERC Roadmaps, like the ones on marine renewables, CCS and the PV roadmap, that has now been through peer review.

In the UKERC Energy 2050 project, Dr Mark Winskel is leading the Energy Supply Working Group (ESWG) which is tasked with: developing and interpreting both a number of 'accelerated technological development' (ATD) scenarios (a UKERC report will be completed by June 2008 on this) and 'socio-environmental sensitivities' (SES) scenarios, and analysing the environmental impact of core and socio-environmental sensitivities scenarios.

Theme members have also been very active in international networking, including engagement with the IEA Ocean Energy and the EU-OEA. Professor Wallace secured funds for, co-sponsored and co-organised two workshops under the British High Commission UK Partners in Science Programme, in Singapore and in Manila. Three UKERC members and one associate were on the tour and presented overviews of the BioEnergy, PV, Wind, Distributed Generation and Built Environment activities and opportunities for partnership.

**Demand Reduction** The arrival of Dr Nick Eyre as theme leader has been the key development, alongside other staff changes and some re-focusing, which we would like to discuss with the Supervisory Board.

In the "buildings" workstream, the Personal Carbon Allowances trials report has been published and a Personal Carbon calculator ("Imeasure v3") developed.

In 2008, work on personal carbon trading will be refocused to address social and political acceptability, enforcement, carbon markets and the relationship with the broader policy agenda. New work will focus on market transformation in lighting and ICT.

On the transport side, research is continuing on individual transport policy instruments for the IMPACT website which is being designed with RAL and will be on-line in January 2008. Dr Anable is also contributing to the current TPA project on the effectiveness of transport policy instruments. The industry team is currently working to identify potential energy saving, via energy and exergy

analysis, for a major energy-consuming (CCA) industrial sector on a technical, practical and economic basis.

The Demand reduction team is also contributing to the cross-cutting micro-generation project, focusing on costs and their drivers. Dr Anable is leading the UKERC Energy 2050 Energy Demand Working Group which has made considerable progress linking the DR sectoral models with system level models such as MARKAL.

### **Environmental Sustainability Environmental Sustainability Theme**

members are actively participating in the UKERC Energy 2050 project, particularly through the Energy Supply Working group, developing and interpreting a number of 'socio-environmental sensitivity' and analysing the environmental impact of both core and variant scenarios.

A matrix for assessing environmental impacts which links directly to inputs and outputs from the MARKAL model has been developed. A new appointee has been helped to conduct a systematic analysis of LCA studies on bioenergy to facilitate comparison with other renewable energy sources. This is feeding into the cross-cutting LCA work. A draft bio-energy roadmap is nearly complete and will be uploaded to the website and sent out for peer review in January 2008. UKERC co-organised a meeting with the Carbon Trust on its Bioenergy Accelerator Project at The Meeting Place in November 2007. This helped to develop guidance and ideas for project proposals in this area. Published academic output has been maintained, especially in the area of bio-energy and carbon capture and storage. Media interest in this theme, has been considerable.

A new appointee, at the University of Edinburgh, Katie Begg, will considerably expand the LCA capabilities of this team. Looking forward, a working paper on the use of life-cycle analysis for assessing environmental sustainability of energy technologies will be completed by Spring 2008 while a separate manuscript on the limitations of life-cycle analysis for assessing energy balance of liquid biofuels and biomass will be produced by the summer. The bio-energy roadmap will be peer-reviewed and finalised.

**Energy Systems and Modelling** This theme is progressing with its planned goals but deviations from the timeline have occurred due to researchers taking advantage of major policy and research opportunities.

These have included extensive public policy use of the MARKAL model in the UK Energy White Paper, coordination by 4CMR researchers of key chapters in the IPCC's 4th Assessment report, the UK-Japan Low Carbon Society project (resulting in a Special Issue of the journal *Climate Policy* in association with the National Institute for Environmental Studies in Japan) and a major project for DEFRA on the rebound effect in energy efficiency uptake.

The current emphasis is now on producing academic and other research publications building on the last two years work. Further developments of the MDM-E3 model will include the capacity to incorporate uncertainty analysis.

2008 work will also be driven by the UKERC Energy 2050 project. Professor Ekins is leading the project's Energy Policy Working group. The scenarios which the theme will model have been defined and it will continue its strong networking role by organising a further Annual Energy Modelling Conference in January 2008. Note that from January 2008, the PSI team has moved to Kings College London.

### *UKERC Energy 2050*

The UKERC Energy 2050 project is now being progressed through four Working Groups covering Energy Demand, Energy Supply, Energy Markets and Security, and Energy Policy. Nick Hartley of OXERA, Paul Jefferiss of BP and Doug Parr of Greenpeace have been engaging with these groups as external advisers.

A scenario set has been finalised and the system-level modelling teams (MARKAL, MDM-E3) are preparing to run the first core scenarios. Significant progress has been made in soft-linking the UK energy system models to more detailed technical models developed and operated by the Demand Reduction and Infrastructure and Supply themes.

The final report of the UK Energy 2050 project will be launched in March 2009.

During 2008, a set of thematic technical reports, each of which will be led by one of the Working Groups, will be published. These will cover: Pathways to a Low Carbon Economy; Technology's Contribution to a Low Carbon Economy; Building a Resilient Energy Economy; Sustainable Energy Lifestyles and Behaviour; the Environment and Sustainable Energy; and the UK and Long-term Global Energy Markets. The first two reports, on pathways and the role of technology will be launched in the first half of 2008.

Apart from regular meetings of the four Working Groups, there have been three general meetings of all those directly engaged in the project – at the annual assembly in late June, at a regular UKERC internal meeting in November 2007 and at a specially organised meeting in December. The project will also be addressed at the UKERC Annual Energy Modelling Conference in late January 2008.

#### *Other Cross-theme Activity*

Three other smaller scale, interdisciplinary cross-theme activities are currently under way. These are addressing the potential for micro-generation (Future Sources of Energy, Demand Reduction and Infrastructure and Supply themes), learning rates and innovation processes for emerging energy supply technologies

(Future Sources of Energy and Materials) and Life Cycle Assessment (Future Sources and Environmental Sustainability). The first two will report in 2008.

## **Training**

### *Studentships*

Following the award of £950k from NERC/EPSRC, a further seven UKERC interdisciplinary studentships started in October 2007 complementing the 20 already underway. These were:

- Dougal Burnett, University of Edinburgh: Climate Change and Renewable Energy Portfolios
- Chris Collins, Imperial College: Strategies and Policies for Building Resilience into the Electricity Network
- Dan Eager, University of Edinburgh: Modelling Generation Capacity Margin as a Dynamic Control Problem
- Matthew Evans, University of Exeter: Uncertainty in Wave Energy Prediction: From Wave Analysis to Economic Viability
- Rudra Kapila, University of Edinburgh: Sites, regulations and policies for CO2 capture and geological storage in India
- Ellie Lindsay, University of Central Lancashire: Enhancing biodiversity within biofuel crops; economic impact on users and best practice
- Jennifer Taylor, University of Nottingham: Urban Wind Turbines, Power vs. Nuisance.

Annual reports were received from each of the continuing students. Progress is generally satisfactory, and a pleasing number of students have already contributed to conferences and the peer-reviewed literature. Most have participated in UKERC workshops/activities, including the new "SPARKS" network described below.

One student has had to modify his work plan because of overlaps with parallel work under the RC's Rural Economy and Land Use Programme. The modification initially proposed was not compatible with our definition of interdisciplinarity and discussions are currently under way with the student and supervisors to address this.

- Applications have been invited for a further 7 interdisciplinary studentships, to start in October 2008. This will complete the cohort envisaged with the original and supplementary funding provided for studentships.

### *Summer School*

Following the three successful Summer Schools organised to date our internal steering group has recommended that in 2008 we aim to expand attendees from 50 to about 100. The intent is that the additional participants will be PhD students from outside the UK, with emphasis on those countries with whom energy



collaboration is a priority for the UK – China, India, North America, Brazil, South Africa – and possibly some from the rest of Europe.

The FCO S&T network has in principle agreed to support the initiative through promotion and help in identifying and selecting participants and we are also contacting the RCUK overseas offices. The expansion will also require some changes to the content and lecturers of the School, but the intent is to follow the same model of facilitated delivery and project work. We are currently exploring the possibility of supplementary funding to allow overseas students to spend the subsequent week with a UK research institution active in their own field. If achieved we expect this will support the RCEP ambition for increased international collaboration as well as delivering a richer learning experience and enhanced networking for UK students.

## **Knowledge Transfer**

### *Meeting Place*

The Meeting Place has organised 6 one- or two-day events in the last 6 months and presently has plans for eight substantive events in the coming period, including the Supergen Conference, Annual Assembly and expanded Summer School. One of the co-managers, Jane Palmer, has left to emigrate to New Zealand, and her colleague Sarah Keay-Bright is about to start maternity leave. Replacement staff have been recruited and trained, and we are confident the activity will continue smoothly in spite of the changes.

### *Technology and Policy Assessment*

The TPA function launched its major report, “An assessment of the evidence for economy-wide energy savings from improved energy efficiency”, in October. The report concluded that rebound effects are significant and need to be taken into account in policy formation, but that they do not render energy efficiency policies ineffective. The report covered reviews of five main areas of literature and is supported by separate technical reports. The work provides ample scope for subsequent journal publication and has been well received by academics and government policy analysts.

The shorter follow-in project, “What Policies are most Effective at Reducing Carbon Emissions from Transport?”, is well under way and will be launched in late Spring. Following discussions with the TPA Advisory Group, the next projects will deal with international oil/gas availability (aka “peak oil”) and the environmental and economic benefits of different means of exploiting bio-energy resources.

### *Other Policy Engagement*

HQ, Technology and Policy Assessment, Energy Systems and Modelling, and Infrastructure and Supply all made presentations to BERR Energy Group and the new Office of Climate Change in the second half of 2007. The topics included the UKERC Energy 2050 project, MARKAL modelling, and the TPA investment decisions and rebound effect projects. UKERC also co-hosted a workshop, at the BERR conference centre, on the Transmission Access review and wider international experience of transmission pricing arrangements.

UKERC is currently preparing a response to the new Climate Change Committee's first call for evidence and submitted evidence to the former House of Commons Science and Technology Committee's Inquiry into renewable energy. In January 2008, UKERC hosted a scoping meeting on renewable energy for the new Innovation, Universities and Skills (IUS) Committee. This followed an informal meeting with the Chair and committee clerks. UKERC will be giving oral evidence to the Committee.

#### *National Energy Research Network*

The new Network Manager is now in place. Dr Jeff Hardy joined UKERC from the Royal Society of Chemistry on 2 January and will be responsible for developing NERN as a more active, visible, and value-adding system for the energy research community. He is presently coming up to speed on UKERC and other UK activities, and preparing a work plan to develop NERN. This will include expanding links with industry, increasing information dissemination through the nascent NERN newsletter, and consulting with stakeholders on how NERN can best add value to those active in energy research and development. Preliminary plans also include identifying and bringing together those with active international collaborations outside well-known frameworks such as FP7, and improving links with RDAs and their communities. There has been a preliminary discussion with ETI on their using and participating in NERN to support their own activity, although this remains to be agreed.

A highly successful innovation has been the "SPARKS" network for early career (PhD and early post-doc) researchers. Younger researchers, led by the UKERC interdisciplinary student cohort, have taken ownership of this network and are arranging their own series of seminars with government, business and other stakeholders using a budget allocated by HQ.

UKERC has also agreed to host a new support and analysis team for the Energy Research Partnership. The ERP members have in principle agreed funding and a formal collaboration agreement is being reviewed for signature to provide the legal framework. Applicants for a Director and two analysts have been interviewed and preferred candidates identified. It is expected offers will be made formally by mid-January. The ERP team will have a close interaction with UKERC although it will pursue specific objectives agreed by ERP.

## *Research Atlas*

The scope of the Research Register continues to be expanded. It now covers 1009 awards from EPSRC, BERR, the Carbon Trust, DfT, DEFRA, DCLG, ESRC, BBSRC, and the Highways Agency. An average of six visitors per day access the Research Register.

All the Research Landscapes have now been peer-reviewed and activity has largely moved to a care and maintenance basis. Work continues on three new landscapes covering wind energy, buildings energy use, and social science centres and groups. Six visitors per day access the Research Landscapes.

The UKERC PV Roadmap has been peer-reviewed and finalised. Draft roadmaps for Carbon Capture and Storage and Marine renewable are publicly available and are currently undergoing per review. A bio-energy roadmap is under development. Four visitors per day access the Research Roadmaps.

Progress with the Energy Data Centre has been slow, largely because of difficulties engaging stakeholders. THE EDC does contain a comprehensive set of links to external data sources such as IEA and BERR.

## **Communications**

### *Media*

This has been a particularly successful period for media coverage of UKERC. The launch of the "The Rebound effect" report in November 2007 received substantial media attention hitting the headlines in high profile media organisations such as Sky News, BBC News, BBC Online, Daily Mail, Daily Telegraph, BBC Radio 4, BBC World Service... The rebound report accounted in itself for an impressive 17% of all UKERC coverage achieved since 2005.

UKERC continued to raise its profile with a clear predominance of high audience national newspapers and broadcast channels over regional and trade press. 57% of this coverage is UKERC specific with mentions of UKERC or reflecting UKERC researchers' opinion. Other topics outside the rebound report got the attention of media like the Guardian, BBC News at 10, FT, Reuters, the Observer, The Economist or Nature among others.

### *Website*

In the last six months UKERC has made the transition to a new and more robust content management system, migrating all the content to what has been up to date a more reliable website. Training is under way for other groups within UKERC to manage their own pages and be able to change the layout or upload their own content allowing them more independence in this process.

Internal communication continued to be an important issue and was delivered via internal events to progress the UKERC Energy 2050 project, responses to consultations, monthly newsletters and the Intranet.

Over the next six months the focus will be on implementing interactive forums to enhance discussion and exchange of ideas between expert groups on the website. The NERN network will become a reality after the appointment of a new network manager and we hope to progress in the creation of a NERN extranet that could be the meeting point of all energy related researchers in the UK.

## **International Links**

Following discussions with DEFRA, three UKERC participants were nominated by the UK, and accepted, as lead authors of the new IPCC Special Report on renewable energy. The Research Director continues as a UK representative on the FP7 Energy Committee and the International Science Panel on Renewable Energy set up by the International Council of Scientific Unions.

UKERC has been working with DEFRA, the Ministry of Environment Japan and the National Institute for Environmental Studies (NIES) to organise the final workshop of the "UK-Japan Low Carbon Society" project in Tokyo in February. This will feed into the final stages of the Gleneagles Dialogue under Japan's chairmanship of G8. Joint scenario/modelling work conducted by UKERC, NIES and researchers from other developed and developing countries will be published in special issue of the journal "Climate Policy" in mid-2008.

John Loughhead has recently been appointed co-Chair of the Implementation Committee of IPHE (International Partnership for the Hydrogen Economy). He was also invited to give a presentation to a member states meeting on options for the new European Strategic Energy Technology Plan, and subsequently consulted by the Portuguese Presidency at drafting stage.

## **Management**

On the management side, UKERC continued having regular meetings and communications with the Supervisory Board members (July 07), the Advisory Board (June 07), and the Theme Directors Committee at the end of October 07 and during the Annual Assembly held in June. Alongside a November internal event attended by all the UKERC members and the regular quarterly meetings run by each theme, these complete the activities aimed to ensure smooth communication between all members and stakeholders.

Regarding the locations of the themes, please note that from January 2008 the PSI team has moved to King's College, WBS Infrastructure to Exeter and that the Manchester team will be soon moving to Cardiff.

# Appendix 1

## UKERC Demand Reduction Theme- the conceptual framework

Energy use is fundamental to modern societies and is therefore the product of a very large number of decisions, by a wide range of actors, in diverse situations and using many technologies.

Quantitatively, energy demand is determined by two factors: the demand for energy services (e.g. comfort, illumination, mobility) and the technical efficiency with which those services are provided. Energy demand research has historically focused largely on energy efficiency improvement, as this tends to support all energy policy objectives. Reducing energy service demand has (widely, although not universally) been considered as economically and socially damaging. However, concerns about climate limits and energy security have raised the need to research the potential for significant reductions in absolute energy consumption in developed economies. This points to the need for research in both energy efficiency and energy service demand.

Energy service demand is driven by economic and social factors and largely addressed through social science research methods. Energy efficiency research, on the other hand, has strong contributions from natural sciences and engineering, but with well-established inputs from economics, psychology and social sciences. Overall, energy use is a complex, multi-disciplinary problem – there is no ‘unified theory of energy demand’.

Research issues for energy use are made more complex by the need to consider the possibility of radical change, for example very low energy scenarios. Under these conditions, historical trends may be a poor guide to the future and change may be systematic rather than incremental.

In this context, natural sciences, engineering, mathematical modelling, behavioural, sociological and political science methods all have a role to play in research on energy use. Inter-disciplinarity is therefore critical. Different emphases are more or less appropriate to different types of energy use (for example, the assumptions of classical economics are generally more tenable for energy intensive companies than for vulnerable households).

With the budget available to the Demand Reduction Theme, it is not realistic to undertake a thorough, multi-disciplinary analysis of every aspect of energy demand in the UK. The Theme has therefore identified approaches best placed to fill existing research gaps, in the context of trends and drivers of UK energy demand over the next half century. The following priorities have been chosen:

- in transport – a review of the literature on policy instruments designed to reduce demand for energy intensive transport modes (road and air), and

integration of these into a technically oriented model of UK transport energy demand.

- in the residential sector – development and use of an open access, technical model of the housing stock and policy analysis of novel instruments designed to address energy service demands, e.g. carbon caps.
- in non-domestic buildings – technological options for constraining the fastest growing areas of energy demand - lighting and ICT.
- in industry – research on the thermodynamics of key energy intensive industrial sectors.
- the role of energy demand in the broader energy system – through contributions to the cross-theme work of UKERC in the '2050 project', Research Atlas, Meeting Place and Technology and Policy Assessment.

In a number of areas, the Demand Reduction theme work addresses the institutional and policy frameworks that impact on energy use. We recognise that this inevitably involve dealing with issues that are contested and politically contentious (e.g. the balance between social and environmental goals). In common with other UKERC activities, we see the role of the Demand Reduction theme work is to analyse the effectiveness and interactions of different policy choices and thereby inform the policy-making process, not to lobby for specific options.

## Appendix 2

### Demand Reduction

July – Dec 2007		
July – Dec 2007	R. Research Programme Overview	
R.1	Review of Milestones incl outputs	<p><b>Buildings</b></p> <ul style="list-style-type: none"> <li>▪ Personal Carbon Allowances trials report completed and published</li> <li>▪ Personal Carbon calculator Imeasure v3 developed</li> <li>▪ Prototype business carbon calculator developed</li> <li>▪ Weekly degree day made available to energy managers</li> </ul> <p><b>Transport</b></p> <ul style="list-style-type: none"> <li>▪ Research continuing on individual transport policy instruments for IMPACT. Design of website has started with RAL. To be on-line January 2008</li> <li>▪ Meeting place event held (30th October) on cost of abating carbon in the transport sector. Working paper to be produced from this and other research</li> <li>▪ Presentations at International conference on transport and climate change in New Zealand (and meetings with NZ Government officials, November 2007) at UK Conference (Climate change: setting the transport agenda), London, October 2007.</li> <li>▪ Transport Research Atlas updated and re-submitted</li> </ul> <p><b>Industry</b> See papers published below</p> <p><b>Energy 2050</b></p> <ul style="list-style-type: none"> <li>▪ Modelling approach between system and sectoral models agreed</li> <li>▪ Input made on costs, energy service demands and policy</li> </ul>
R.2	Progress against plan (brief narrative highlighting progress/changes from planned activity)	<p><b>Buildings</b></p> <ul style="list-style-type: none"> <li>▪ Significant changes in personnel have delayed some deliverables. Opportunity of staff changes has been taken to review direction of work.</li> <li>▪ Personal Carbon Allowances journal paper only partly drafted due to time taken in peer review process of PCA trials report</li> <li>▪ eceee paper on carbon calculators submitted as journal paper, but needs revision to be accepted</li> </ul> <p><b>Transport</b></p> <ul style="list-style-type: none"> <li>▪ Delay in recruiting transport researcher at ECI has contributed to some delay in the Launch of IMPACT</li> </ul> <p><b>Industry</b></p> <ul style="list-style-type: none"> <li>▪ On timetable</li> </ul>

		<p>Energy 2050</p> <ul style="list-style-type: none"> <li>▪ Significant unbudgeted work in Demand and Policy Working groups</li> </ul>
<p><b>R.3</b></p>	<p>Plan for coming 6 months (activities, output)</p>	<p>Buildings</p> <ul style="list-style-type: none"> <li>▪ Work on personal carbon trading will be refocused on research on social and political acceptability, enforcement, carbon markets and relationship with the broader policy agenda. Two working papers planned.</li> <li>▪ Work on personal and business carbon calculators based on actual metered data to continue as a means to get good quality data for research, e.g. on personal carbon footprints.</li> <li>▪ New workstream on market transformation in lighting and ICT. Envisaged output is working paper or research report.</li> </ul> <p>Transport</p> <ul style="list-style-type: none"> <li>▪ Working paper on costs of abating carbon from the transport sector</li> <li>▪ Series of briefing notes on IMPACT website on issues related to transport and energy reduction</li> <li>▪ IMPACT – continual updating existing policy entries and new policies and moderating the interactive element</li> <li>▪ Develop scenarios to be tested with UKTCM</li> <li>▪ Transport research atlas: updating</li> <li>▪ Book chapter with D Banister on transport and climate change</li> </ul> <p>Industry</p> <ul style="list-style-type: none"> <li>▪ Identify potential energy saving, via energy and exergy analysis for a major energy-consuming (CCA) industrial sector on a technical, practical and economic basis.</li> <li>▪ Identify relevant SIC classification and Trade Association, establish relationship/liaise, and collect data.</li> <li>▪ Establish best practice.</li> <li>▪ Discuss with stakeholders.</li> <li>▪ Write up a paper(s) on areas with the greatest savings.</li> </ul> <p>Micro-generation</p> <ul style="list-style-type: none"> <li>▪ New activity researching micro-generation costs and their drivers to begin January 2008.</li> </ul> <p>Energy 2050</p> <ul style="list-style-type: none"> <li>▪ Input into Energy 2050 on energy demand in buildings and transport, micro-generation costs, scenario development and policy drivers. Envisaged that this will involve model runs of UKDCM and UKTCM.</li> </ul>



July – Dec 2007	
July – Dec 2007	P. Publications
<b>P.1 Journal Articles</b>	<ul style="list-style-type: none"> <li>▪ Boardman, B, <i>Examining the carbon agenda: the issues raised by a 40% housing stock</i>. Building Research &amp; Information 35(4), p 363–378, 2007.</li> <li>▪ Anable, J. and Shaw, J. (2007) Priorities, policies and timescales: geography and the delivery of emissions reductions in the UK transport sector. AREA, 39: 4, pp.443-457.</li> <li>▪ Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A. and Goodwin, P. (forthcoming) Smarter Choices: Assessing the potential to achieve traffic reduction using 'soft measures'. Accepted for publication in Transport Reviews</li> <li>▪ Grubbström, R.W., G.P. Hammond, S.D. Probert and A.P.S. Reis (eds), 2007. 'Industrial energy-analysis and management: a European perspective', <i>Applied Energy</i>, <b>84</b> (7-8), 671-674 [DOI:10.1016/j.apenergy.2007.01.001] – guest editorial for a special issue, based on papers (14 out of 64) presented at the 3rd European Congress on <i>Economics and Management of Energy in Industry</i>, Estoril/Lisbon, 6-9 April 2004.</li> <li>▪ Hammond, G.P., 2007. 'Industrial energy analysis, thermodynamics and sustainability (In memoriam: Willem van Gool)', <i>Applied Energy</i>, <b>84</b> (7-8): 675-700 [DOI: 10.1016/j.apenergy.2007.01.022].</li> <li>▪ Hammond, G.P., 2007. 'Energy and sustainability in a complex world: reflections on the ideas of Howard T. Odum', <i>International Journal of Energy Research</i>, 31 (12): 1105-1130 [DOI: 10.1002/er.1323] – text of a Keynote Lecture presented at the '2nd International Green Energy Conference' (IGEC-2). UOIT, Oshawa, Ontario, Canada, 25-29 June 2006.</li> <li>▪ Hammond, G.P. and S.S. 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>, <b>31</b> (12): 1180-1201 [DOI: 10.1002/er.1328] – invited contribution to a Special Edition on 'Green Energy'.</li> </ul>
<b>P.2 Books/ Books Chapters</b>	<ul style="list-style-type: none"> <li>▪ Stradling, S.; Anable, J.; Anderson, T. and Cronberg, A (2008) Attitudes to car use and the environment. In Park, A., Curtice, J., Thomson, K., Phillips, M., Johnson, M. and Clery, E. (eds.) <i>British Social Attitudes: the 24th Report</i>, London: Sage</li> <li>▪ Stradling, S. and Anable, J. (2008) Individual Travel Patterns. In R. Knowles, J. Shaw &amp; I. Docherty (eds.), <i>Transport Geographies: an introduction</i>. Blackwell Publishing</li> <li>▪ Boardman B. Contributing author for the IPCC WG III Fourth Assessment Report chapter on Buildings.</li> </ul>
<b>P.3 Reports/ Conference papers/presentations/working papers/meetings reports</b>	<ul style="list-style-type: none"> <li>▪ Fawcett, T, Bottrill, C., Boardman, B. and Lye, G. Trialling personal carbon allowances. UKERC Research Report, London, 2007.</li> <li>▪ Boardman, B. 'Home truths' – A strategy to reduce UK housing emissions by 80% by 2050. ECI report.</li> <li>▪ Hinnells, M., Boardman, B., Darby, S., Killip, G. and Layberry, R.. Transforming UK homes: achieving a 60 % cut in carbon emissions by 2050. Proceedings, European Council for an Energy-Efficient Economy Summer Study, 4th – 9th June 2007, Nice, France.</li> <li>▪ White, R. Carbon governance from a systems perspective: An investigation of food production and consumption in the UK. Proceedings, European Council for an Energy-Efficient Economy Summer Study, 4th – 9th June 2007, Nice, France.</li> <li>▪ Bottrill C, Internet-based tools for behaviour change. Proceedings, European Council for an Energy-Efficient Economy Summer Study. 4th – 9th June 2007, Nice, France.</li> <li>▪ Brand C, Personal Travel by Car and Air: don't do it! Proceedings, European</li> </ul>

	<p>Council for an Energy-Efficient Economy Summer Study. 4th – 9th June 2007, Nice, France.</p> <ul style="list-style-type: none"> <li>▪ Palmer J, Boardman B, Bottrill C, Darby S, Hinnells M, Killip G, Layberry R, Lovell H (2006). Reducing the environmental impact of housing. Final Report. Consultancy study in support of the Royal Commission on Environmental Pollution's 26th Report on the Urban Environment. Report published 2007</li> <li>▪ Boardman, B. Reducing personal carbon obesity. Presented at British Association for the advancement of science, Festival of Science, York, 12th September 2007</li> <li>▪ Eyre, N.J. Energy futures: problems, possibilities and people. Presented at British Association for the advancement of science, Festival of Science, York, 12th September 2007</li> <li>▪ Anable, J. Smart choices – transport and climate change presented at: Transforming Transport in a Climate-constrained world 14 November 2007, Victoria University of Wellington, New Zealand</li> <li>▪ Anable, J. Public attitudes to transport and climate change presented at: Climate change: setting the transport agenda. The great climate change debate Organised by Steer Davis Gleeve. The British Museum London. 2nd October 2007.</li> <li>▪ Anable, J. Driving to the limit: transport and climate change presented at British Association for the advancement of science, Festival of Science, York, 12th September 2007</li> </ul>
<b>P4. Other</b>	<ul style="list-style-type: none"> <li>▪ T Fawcett, Personal <i>Carbon Allowances. Your own tonnes of carbon</i>. Published for Energy and Environmental Management Magazine (Defra) Nov/Dec 07.</li> </ul>
	<b>N. Network Co-ordination</b>
<b>N.3 Theme meetings engaging those external to UKERC</b>	<ul style="list-style-type: none"> <li>▪ Personal carbon trading work discussed with RSA and ippr.</li> <li>▪ Research evidence on personal carbon trading presented to key environmental and social NGOs.</li> </ul>
	<b>O. Research Opportunities</b>
<b>O.1 Research Atlas: landscapes</b>	<ul style="list-style-type: none"> <li>▪ Anable, J. Transport Research Atlas: Landscape Transport. Database of transport research capability in the UK. First published on-line 2006, peer reviewed and update completed December 2007</li> </ul>
	<b>I. International Engagement</b>
<b>I.5 Meetings international visitors</b>	<ul style="list-style-type: none"> <li>▪ Description of UKERC activities to visitors from Sharp.</li> </ul>
	<b>E. Regional/National Industry Engagement</b>
<b>E.1 Regional-industrial participation in meetings</b>	<ul style="list-style-type: none"> <li>▪ Description of UKERC activities to key ECI visitors, including M&amp;S</li> </ul>
	<b>PL. Policy Links</b>
<b>PL.1 Response to consultation, evidence given to Committees, etc</b>	<ul style="list-style-type: none"> <li>▪ Anable, J. Scottish parliament, Energy, economy and tourism committee: Oral evidence on future energy work programme (Sep 07).</li> <li>▪ Eyre, N.J. Expert advisor to national Audit office Enquiry on 'Energy efficiency'</li> <li>▪ Fawcett, T. Written and oral evidence to Environmental Audit Committee inquiry on personal carbon allowances</li> <li>▪ Darby, S., Fawcett, T., Hinnells, M. and Jardine, C. Written evidence to BERR Consultation on energy billing and metering: changing consumer behaviour.</li> </ul>

	<b>C. Communications</b>
<b>C4 Media Coverage</b>	<ul style="list-style-type: none"> <li>▪ Significant media coverage (press and radio) around launch of 'Home truths'</li> </ul>
	<b>F. Co-funding</b>
<b>F.1</b>	<ul style="list-style-type: none"> <li>▪ Related funding from Friends of the Earth and Co-op Bank for 'Home truths'. Model development done for this work will form part of theme contribution to Energy 2050 work on carbon constrained scenarios.</li> <li>▪ Theme researchers are members of new Joint Information Systems Committee (JISC) project on low carbon ICT (£200k over 18 months) which will provide new evidence on growth of ICT demand in the HE sector</li> <li>▪ Funding from Federation of Masters Builders for work on researching role of small builders in low carbon housing regeneration</li> </ul>
	<b>A. Awards</b>
<b>A.2 Prizes</b>	Nobel Peace Prize - Brenda Boardman (jointly, as IPCC contributing author)

## Energy Infrastructure and Supply

<b>July – Dec 2007</b>	<b>R. Research Programme Overview</b>	
<b>R.1</b>	Review of Milestones incl outputs	<p><b>1 Interactions between gas and electricity networks</b></p> <ol style="list-style-type: none"> <li>1. August 2007: Completion of the gas and electricity expansion extension to the CGEN optimisation model.</li> <li>2. September 2007: CGEN was populated with gas and electricity demand/ supply data up to the year 2020.</li> <li>3. November 2007: CGEN and WASP were used to analyse the UK development needs up to the year 2020. A paper was written for the PSCC 2008 conference.</li> <li>4. December 2007: The methodology of building resilience into the gas and electricity networks using the CGEN model was defined for the UKERC 2050 project.</li> <li>5. December 2007: An abstract on "Sustainable Development of the Gas and Electricity Infrastructure in the UK" was submitted for the UKERC/RCEP 'Sustainable Energy UK' conference.</li> </ol> <p>Major outputs:</p> <ul style="list-style-type: none"> <li>▪ M. Chaudry, N. Jenkins, G. Strbac, 'Multi-time period combined gas and electricity network optimisation', Electric power systems research (paper accepted and awaiting publication)</li> </ul>

		<ul style="list-style-type: none"> <li>▪ M. Chaudry, A. Shakoor, N. Jenkins, G. Strbac, "Medium term Strategic Development of the Gas and Electricity Infrastructure in the UK" paper submitted for the PSCC conference , 2008</li> <li>▪ Working paper to explain the CGEN model in operational mode was completed and is online (UKERC website)</li> </ul> <p><b>Development of UK-Electricity Infrastructure</b></p> <ol style="list-style-type: none"> <li>1. August 2007: Carried out studies to establish the need of new generation in UK up to 2020.</li> <li>2. Sep/ Oct 2007: Developed a base case (business as usual scenario) for generation expansion in the UK up to 2020 under CEGB equivalent reliability standards.</li> <li>3. November 2007: Paper submitted to the PSCC 2008 conference (awaiting acceptance).</li> <li>4. December 2007: Establishing the link between MARKAL, WASP and CGEN models. Identified the data flows to develop consistency among these models for the UKERC 2050 project.</li> <li>5. December 2007: A paper abstract submitted for the UKERC/RCEP 'Sustainable Energy UK' conference.</li> </ol> <p>Major outputs:</p> <ul style="list-style-type: none"> <li>▪ M. Chaudry, A. Shakoor, N. Jenkins, G. Strbac, "Medium term Strategic Development of the Gas and Electricity Infrastructure in the UK" paper submitted for the PSCC conference , 2008</li> <li>▪ Working paper on implementation of WASP model for the UK electricity system expansion planning (will be available on the UKERC website in Jan2008).</li> <li>▪ Two paper abstracts are submitted for the UKERC/RCEP 'Sustainable Energy UK' conference based on present and some future work.</li> </ul> <p><b>Energy infrastructure: Regulatory &amp; policy issues</b></p> <p>IFI/RPZ paper is complete and ready to be sent out for peer review. It is intended to turn this into a UKERC working paper and produce a journal article for publication</p> <p>The transmission paper has expanded from solely considering offshore wind to a broader range of transmission issues, in particular the GB Queue and access for renewables, and the development of plans for transmission in the Western Isles. This is now largely complete; once it is it will be sent out for peer review. It will aim to incorporate as much relevant information as possible from the Transmission Access Review being conducted currently by Ofgem.</p> <p>Microgeneration work is carrying on, mainly as part of the cross cutting microgeneration project. The aim is to produce an outline of policy and regulatory conditions necessary to enable the emergence of viable energy service companies using microgen technologies.</p>
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R.2	Progress against plan (brief narrative highlighting progress/changes from planned activity)	<p><b>Interactions between gas and electricity networks</b></p> <p>This period has seen excellent progress, with the implementation of the CGEN expansion model. The CGEN model has been populated with supply/demand and firm infrastructure plans up to the year 2020.</p> <p>A paper on the CGEN model (operational mode) has been accepted for publication (Electric power systems research). CGEN and WASP were used in an integrated fashion to analyse the development needs of the gas and electricity infrastructure of the UK (2020), a paper has been submitted for the PSCC 2008 conference.</p> <p>The CGEN model is now being updated with supply/demand data up to the year 2050 for the UKERC 2050 project. The main output from CGEN will be the development of a resilient gas and electricity network.</p> <p>It had be planned to complete a report on the incentives that are needed to encourage investment in large scale gas storage facilities, due to work on the UKERC 2050 project this will now be completed by April 2008.</p> <p><b>Development of UK-Electricity Infrastructure</b></p> <p>The planned work and objectives defined for the last six month term (July-December 2007) are accomplished. The work carried during this period has been documented and submitted for publishing. A good link between the WASP and CGEN models has been established that investigates both the generation and delivery component of UK energy infrastructure development in an integrated mode. A framework for interaction between the three key energy modelling tools (MARKAL/WASP/CGEN) was established.</p> <p><b>Energy infrastructure: Regulatory &amp; policy issues</b></p> <p>Progress has been slower than anticipated, partly because of moving from Warwick to Exeter, partly because of the expansion of the transmission paper. This was considered sensible given that the general approach of the project's work is the regulatory and policy conditions which can enable the deployment of sustainable energy technologies. The issue of transmission access and more general questions about expansion of the UK's transmission system both fit this framework and therefore complement the offshore transmission work.</p>

<p><b>R.3</b></p>	<p>Plan for coming 6 months (activities, output)</p>	<p><b>Activities (Jan – Jun, 2008)</b></p> <p><b>Interactions between gas and electricity networks</b></p> <ul style="list-style-type: none"> <li>▪ January 2008: Present an introduction to the CGEN optimisation model at the UKERC Energy Modelling Conference, Oxford</li> <li>▪ February 2008: Update the CGEN model with supply/demand data from MARKAL and WASP up to the year 2050</li> <li>▪ March 2008: Complete a journal paper with A. Shakoor on energy infrastructure options for the UK</li> <li>▪ June 2008: Complete all work on the resilience of gas and electricity networks for the UKERC 2050 project</li> </ul> <p>Major outputs:</p> <ol style="list-style-type: none"> <li>1) Least cost energy infrastructure development options for the UK under various uncertainties: Energy policy paper, March 2008</li> <li>2) What incentives are needed to encourage investment in large scale gas storage facilities: Evidence based evaluation : Report, April 2008</li> <li>3) UKERC 2050 project, building resilience into the gas and electricity networks: Report, June 2008</li> </ol> <p><b>Development of UK-Electricity Infrastructure</b></p> <ol style="list-style-type: none"> <li>1. Populating the WASP model with data input and assumptions consistent with MARKAL</li> <li>2. Developing generation expansion plans up to 2030 and 2050 in line with UKERC HQ's core scenarios</li> <li>3. Investigating the development of resilient generation options for the UK</li> </ol> <p>Major outputs:</p> <p>Two journal papers are planned; one as given above in 1 of <i>Interactions between gas and electricity networks</i>, and a second paper based on the work related to development of UKERC core scenarios</p> <p><b>Energy infrastructure: Regulatory &amp; policy issues</b></p> <p>Bridget Woodman will continue with finalising the two areas of work (IFI/RPZ and transmission), and also ongoing work on microgeneration.</p> <p>We will be recruiting a new researcher to replace Bridget Woodman and complete the programme of work as soon as possible (probably in the new year). The first area of work will be on market design issues.</p>
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July – Dec 2007	
<b>July – Dec 2007</b>	<b>P. Publications</b>
<b>P.1 Journal Articles</b>	<ul style="list-style-type: none"> <li>▪ M. Chaudry, N. Jenkins, G. Strbac, 'Multi-time period combined gas and electricity network optimisation',</li> <li>▪ Electric power system research (paper accepted and awaiting publication)</li> </ul>
<b>P.4 Other</b>	<ul style="list-style-type: none"> <li>▪ Woodman B, The Energy White Paper - much more than an anti-climax Power UK, August pp 30 - 31</li> </ul>
	<b>I. International Engagement</b>
<b>I.2 Conferences/ Workshops for which UK attend. facilitated</b>	<ul style="list-style-type: none"> <li>▪ The Energy White Paper: An Academic Critique BIEE and UKERC, London, 25th September (attended by Modassar Chaudry, Anser Shakoor)</li> <li>▪ 6th Conference on Applied Infrastructure Research, Berlin Germany, 5-6th October 2007 (attended by Modassar Chaudry)</li> </ul> <p>Meetings with the UK Department of Business and Regulatory Reforms (DBERR) Security of supply group.</p>
	<b>E. Regional/National Industry Engagement</b>
<b>E.3 National /Industrial participation meetings</b>	<ul style="list-style-type: none"> <li>▪ DTI/Ofgem Microgeneration Forum involving participants from DNOs, and microgeneration manufacturers and suppliers. The aim is to report on policy and regulatory developments and the implementation of the Government's Microgen strategy. (Bridget Woodman)</li> </ul>

## Future Sources of Energy

July – Dec 2007	
<b>July – Dec 2007</b>	<b>R. Research Programme Overview</b>
<b>R.1</b>	<p>Review of Milestones incl outputs</p> <p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ Road Map for CCS in UK; Draft completed and posted on UKERC web. Reviewers comments received.</li> <li>▪ Research Landscape for Atlas – revised and updated, currently being checked before delivery to UKERC</li> <li>▪ UKERC2050 Cross-cutting research FSE Learning Rates of CCS – preliminary input submitted</li> <li>▪ Specialist discipline papers prepared and submitted</li> <li>▪ Capacity building with new staff: RA, PhD, PDRA</li> </ul> <p><b>Future Sources (General) - Learning rates and learning effects</b></p> <ul style="list-style-type: none"> <li>▪ 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.</li> </ul> <p><b>Marine</b></p> <ul style="list-style-type: none"> <li>▪ Draft UKERC roadmap is now complete, and posted on UKERC website as a working paper.</li> <li>▪ Working paper on Landscape Analysis in context of roadmap will be completed in Jan 2008</li> <li>▪ Jeffrey presented the UKERC Marine Roadmap to the EU Ocean Energy Rep, Anna Gigatino</li> <li>▪ Jeffrey presented the UKERC Marine Roadmap to the NRCAN (Canada), who have agreed to adopt it.</li> </ul>

		<ul style="list-style-type: none"> <li>Discussions with EU-Ocean Energy Association and CA-OE are ongoing.</li> </ul>
R.2	Progress against plan (brief narrative highlighting progress/changes from planned activity)	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>Rapid and diverse development of the commercial and academic CCS landscape continues, with the UK competition announced by BERR, and research funding streams from TSB, ETI (in prospect), and awards by EPSRC.</li> <li>UKERC work has maintained and updated the previously compiled Atlas, and now issued the draft copy of the first UK Road Map for CCS. New work has been initiated as part of the UKERC 2050 project on scenarios of UK future energy mix. This initially focused on Life Cycle Analysis of emissions. Since September, recruitment of Nils Markusson (PDRA) has enabled development of work on Learning Rates for cost reduction during CCS deployment. Provisional input has been made to MARKAL and E3MG and MDM-E3 modelling data, in a common UKERC format.</li> <li>Original research on natural processes by which CO<sub>2</sub> is geologically stored and sequestered</li> </ul> <p><b>Future Sources (General) - Learning rates and learning effects</b></p> <ul style="list-style-type: none"> <li>Cross-technology working paper (by Winskel, Markusson and Jeffrey) is being drafted for circulation within the UKERC Learning Rates Working Group. A marine energy specific working paper (by Jeffrey) is being drafted for circulation in the UKERC Learning Rates Working Group.</li> <li>However, since July 2007, much of the work on learning rates and learning effects has been carried out under the remit of the Energy Supply Working Group of the UKERC Energy 2050 integrating project (see below).</li> </ul>
R.3	Plan for coming 6 months (activities, output)	<p><b>Future Sources (General) - Energy Supply Working Group</b></p> <ul style="list-style-type: none"> <li>FSE theme members – along with Energy Systems and Modelling and Environmental Sustainability theme members – are contributing to the UKERC Energy 2050 integrating project by participation in the Energy Supply Working Group (ESWG). The ESWG has three tasks: <ol style="list-style-type: none"> <li>Develop and interpret a number of ‘accelerated technological development’ (ATD) variant scenarios.</li> <li>Develop and interpret a number of ‘socio-environmental sensitivities’ (SES) variant scenarios.</li> <li>Analyse the environmental impact of core and socio-environmental sensitivities variant scenarios (EIA).</li> </ol> Draft contributions to the Energy 2050 project have been developed for all 3 tasks in the</li> </ul>



		<p>period July-December 2007.  A UKERC Research Report based on Task 1 will be completed by end-June 2008.  The research report will include a chapter on learning rates and learning effects for emerging energy technologies, building on the working paper produced by the learning rates working group.  This working paper will also be submitted for publication in a leading energy policy journal.</p> <p><b>Nuclear Fusion</b></p> <ul style="list-style-type: none"> <li>▪ Accelerated Technological Learning information on fusion as a guide to MARKAL modelling of variant scenarios.</li> </ul> <p><b>Photovoltaics</b></p> <ul style="list-style-type: none"> <li>▪ To continue the micro-gen sub-project</li> <li>▪ To continue to work on international outreach</li> <li>▪ To start a wind research road mapping process</li> </ul> <p><b>Marine</b></p> <ul style="list-style-type: none"> <li>▪ Combine 2 UKERC working papers on Marine Technology Roadmap and Landscape Analysis into a research report for publication in February 2008.</li> <li>▪ Continue international engagement through the IEA Ocean Energy group, and the EU-OEA within Europe.</li> <li>▪ Assess the impact of the learning rates work on the pathways defined in the roadmap</li> <li>▪ Submit a paper to an international energy policy journal on the outcomes and recommendations from the marine technology roadmap.</li> <li>▪ Attend and participate fully in the scoping and Call for Proposals in ETI Marine Energy.</li> <li>▪ Co-organise exploratory workshop on marine energy collaborative R&amp;D with ASEA Partners in Singapore in March</li> </ul>
<b>July – Dec 2007</b>	<b>P. Publications</b>	
<b>P.1 Journal Articles</b>	<p><b>Bioenergy</b></p> <ul style="list-style-type: none"> <li>▪ Taylor G et al. Delayed Autumnal Senescence in future CO<sub>2</sub></li> <li>▪ Global Change Biology – early on-line</li> </ul> <p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ Submitted, rejected, resubmitted Wilkinson M, Haszeldine RS, Stoker S, Gatliff R (2008) "First occurrence of dawsonite in UK, and effect on CCS" Geology</li> <li>▪ Accepted, awaiting proofs Mark Wilkinson, Stuart M. V. Gilfillan, R. Stuart Haszeldine, and Chris J. Ballentine 2008 Plumbing the depths – testing natural tracers of subsurface CO<sub>2</sub> origin and migration, Utah, USA. American Assocn Petroleum Geologists. Ed M Grosse, Spec Publ</li> <li>▪ In preparation Cavanagh AJ, Haszeldine RS 2008 " Calibrated model of CO<sub>2</sub> seepage from aquifer storage" Science</li> <li>▪ Submitted (international). Regulating the Geological Sequestration of Carbon Dioxide 2008 Wilson EJ, Morgan GM, and 17 others Environmental Science and Technology.</li> <li>▪ Submitted Jiemin Lu, Mark Wilkinson, R. Stuart Haszeldine, Anthony E. Fallick 2008 Evidence for natural long-term CO<sub>2</sub> storage. Geology</li> </ul> <p><b>Photovoltaics</b></p> <ul style="list-style-type: none"> <li>▪ Paper in progress by Micro-generation su-project team.</li> </ul> <p><b>Marine</b></p> <ul style="list-style-type: none"> <li>▪ Development of a Linear Test Rig for Electrical Power Take Off from Waves, Baker, Mueller, Ran, Tavner &amp; McDonald, Proceedings of the IMAREST Journal on Marine Engineering Technology, Sept. 2007.</li> </ul>	

<p><b>P.2 Books/ Books Chapters</b></p>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ Accepted, proofs read, in press <i>Bushby Y.E., Gilfillan S.M.V. and Haszeldine R.S</i> "Carbon Capture and Storage in the UK" In <i>Energy and the Natural Heritage</i>, ed. by C.A. Galbraith and J.M. Baxter. TSO Scotland, Edinburgh</li> </ul> <p><b>Nuclear Fusion</b></p> <ul style="list-style-type: none"> <li>▪ Fusion Energy – Chapter 7 in <i>Energy – Beyond Oil</i>, Ed Armstrong and Blundell, OUP 2007</li> </ul> <p><b>Photovoltaics</b></p> <ul style="list-style-type: none"> <li>▪ Chapter on PV contributed to Elsevier book on renewables. To be published</li> </ul>
<p><b>P.3 Reports/ Conference papers/presentations/working papers/meetings reports</b></p>	<p><b>Bioenergy</b></p> <ul style="list-style-type: none"> <li>▪ 1. Taylor, G. Presentation at the Singapore A * -UK Renewable energy meeting and the Philippines_ UK Renewable energy and sustainability workshop, 'Bioenergy Research in the UK – Current status and future prospects'. Nov 25-29.</li> <li>▪ 2. Taylor G. Presentation at 'The Carbon Trust' meeting on Directed research in Bioenergy' on UK Bioenergy Research.,Nov 12.</li> <li>▪ 3. Taylor G, Departmental Seminar, University of Nottingham ' Bioechnology for bioenergy' Dec 5 .</li> </ul> <p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ Carbon Capture and Storage. DEFRA briefing note. Melanie Smallman, Haszeldine and Kapila</li> <li>▪ Haszeldine RS 2008 Bury it deep. <i>Chemistry World</i> 4 (10) 42-46.</li> <li>▪ Haszeldine invited presentation Carbon Capture and Storage 14 Sept 2008 CoalTrans conference, Clean Coal and Carbon Capture</li> <li>▪ Haszeldine invited presentation 9 October 2007, Carbon Capture and Storage economics Synnogy, London</li> <li>▪ Haszeldine, invited keynote presentation, 1 Nov 2007, Exploring for CO2 storage sites. First international summer School on CCS, Erice, Italy</li> <li>▪ 13 Nov (Wilkinson) Invited presentation Carbon Capture and Storage, Peterborough joint panel (engineers)</li> </ul> <p><b>Future Sources (General)</b></p> <ul style="list-style-type: none"> <li>▪ Draft report 'UKERC Marine Energy Technology Roadmap (Mueller and Jeffrey)' completed and circulated to key stakeholders.</li> <li>▪ The UKERC Energy Supply Working Group (ESWG) convened on nine occasions in Sep-Nov 2007, to progress ESWG contributions to the Energy 2050 project. (Minutes of meetings are available on the UKERC intranet).</li> <li>▪ Winskel presented 'Technology acceleration and technology learning' and made a progress report on the ESWG at the UKERC Internal Meeting, 2nd November 2007, London</li> </ul> <p><b>Photovoltaics</b></p> <ul style="list-style-type: none"> <li>○ Final version of PV Research Road Map published.</li> </ul> <p><b>Marine</b></p> <ul style="list-style-type: none"> <li>▪ Draft report 'UKERC Marine Energy Technology Roadmap (Mueller and Jeffrey)' completed and circulated to key stakeholders</li> <li>▪ Powerpoint presentation of the complete roadmap has been uploaded onto the FSE website.</li> </ul> <p>The following papers have been accepted for conference presentations in 2008.</p> <ul style="list-style-type: none"> <li>▪ S. Caraher, J. Chick, MA Mueller, Investigation of Fluid Film Bearings for use in Direct Drive Linear Generators in submerged wave energy converters, to be presented at ISOPE, Vancouver, 2008</li> <li>▪ MA Mueller, N. Baker, L. Ran, N. Chong, H. Wei, P. Tavner, P. McKeever, Experimental tests of an air-cored PM tubular generator for direct drive wave energy converters, to be presented at IET PEMD Conference, York, UK, April 2008</li> <li>▪ N. Hodgins, MA Mueller, K Tease, T. Heath, Measurement and Modelling of Induction Generator Performance in an Oscillating Water Column Wave Energy Converter, to be presented at IET PEMD Conference, York, UK, April 2008</li> <li>▪ A, McDonald, MA Mueller, J. Jeffrey, K. Ochije, Development Of A Novel Permanent Magnet Linear Generator Topology For Direct-Drive Wave Energy</li> </ul>

	Converters, to be presented at IET PEMD Conference, York, UK, April 2008
	<b>N. Network Co-ordination</b>
<b>N.3 Theme meetings engaging those external to UKERC</b>	<p><b>Bioenergy</b></p> <ul style="list-style-type: none"> <li>▪ The Carbon Trust Meeting, Oxford, on UKERC activity in Bioenergy, presented at the meeting.</li> <li>▪ Agreement to co-brand and help provide articles for the magazine 'British Bioenergy News' in all future editions.</li> </ul> <p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 17-18 Sept UK CCS Consortium, TSEC meeting Newcastle</li> </ul>
	<b>O. Research Opportunities</b>
<b>O.1 Research Atlas: landscapes</b>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>○ Research Landscape for Atlas, revised draft completed and being checked</li> </ul> <p><b>Future Sources (General)</b></p> <ul style="list-style-type: none"> <li>▪ Revised version of the Research Landscape on Ocean Energy uploaded to UKERC Research Atlas on 7-11-07</li> <li>▪ Revised version of the Research Landscape on BioEnergy uploaded to UKERC Research Atlas on 26-09-07</li> <li>▪ Revised version of the Research Landscape on Nuclear Fission uploaded to UKERC Research Atlas on 07-11-07</li> </ul>
<b>O.2 Research Atlas: roadmaps</b>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>○ Road Map for CCS in UK; Draft completed and posted on UKERC web. Reviewers comments received.</li> </ul> <p><b>Future Sources (General)</b></p> <ul style="list-style-type: none"> <li>▪ Solar Energy Roadmap uploaded on 07-09-07</li> <li>▪ Research Roadmaps on bioenergy, marine energy, carbon capture and storage and nuclear fission are being prepared.</li> </ul>
<b>O.3 UKERC 2050</b>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ Markusson UKERC2050, regular teleconferences</li> </ul>
	<b>I. International Engagement</b>
<b>I.1 Confer/ Workshops organised</b>	<p><b>Future Sources (General)</b></p> <ul style="list-style-type: none"> <li>▪ Wallace secured funds for, co-sponsored and co-organised two workshops under the British High Commission UK Partners in Science Programme, one in Singapore and one in Manila. He presented on the Energy R&amp;D Landscape and in the UK and the EPSRC Energy Programme. Three four UKERC staff and one other senior UK academic were on the tour, and presented overviews of the BioEnergy, PV, Wind, Distibuted Generation and Built Environment activities and opportunities for partnership.</li> </ul> <p><b>Bioenergy</b></p> <ul style="list-style-type: none"> <li>▪ Organisation of Society of Experimental Biology session on 'Bioenergy', June 2008, Cote du Azur.</li> </ul>
<b>I.2 Conferences/Works hops for which UK attendce facilitated</b>	<p><b>Bioenergy</b></p> <ul style="list-style-type: none"> <li>▪ Contribution to DEFRA consultation on international trade in biofuels.</li> </ul> <p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 31 Oct – 3 Nov Haszeldine First international summer school on CCS, Erice, Italy</li> <li>▪ 7 Nov Haszeldine Carbon markets Inst Advanced Study European seminar, Durham</li> </ul> <p><b>Future Sources (General)</b></p> <ul style="list-style-type: none"> <li>▪ Jeffrey attended the Ocean Renewable Energy group conference in St John Canada 25<sup>th</sup> Oct</li> </ul> <p><b>Photovoltaics</b></p> <ul style="list-style-type: none"> <li>▪ Presentation to Finnish Physics Society on PV research and road mapping,</li> </ul>

	<p>September 2007.</p> <ul style="list-style-type: none"> <li>▪ Presentation to EPFL Renewables in Buildings conference, September 2007.</li> </ul> <p><b>Marine</b></p> <ul style="list-style-type: none"> <li>▪ Jeffrey attended the Ocean Renewable Energy group conference in St John Canada 25<sup>th</sup> Oct</li> </ul>
<b>I.3 Participation in international initiatives</b>	<p><b>Bioenergy</b></p> <ul style="list-style-type: none"> <li>▪ Taylor, G UK Singapore and Philippines workshops on Renewable Energy and Sustainability</li> </ul> <p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 3 Oct Markusson Zero Emissions Programme Ann Assembly, Paris</li> <li>▪ 6 – 8 Nov Wilkinson CO2net Annual network assembly, Lisbon</li> <li>▪ 8 – 9 Nov Kapila Regulation for CCS. International Risk Governance Council, Zurich</li> </ul> <p><b>Marine</b></p> <ul style="list-style-type: none"> <li>▪ Jeffrey was invited to present the marine roadmap in Ottawa Canada to workshop organised by the UK FCO 29-30<sup>th</sup> Oct</li> </ul>
<b>I. 4 Overseas visits</b>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 3 Oct Markusson Zero Emissions Programme Ann Assembly, Paris</li> <li>▪ 6 – 8 Nov Wilkinson CO2net Annual network assembly, Lisbon</li> <li>▪ Future Sources (General)</li> <li>▪ Jeffrey met with EU to present the Marine roadmap in Brussels for possible EU adoption 12th Nov</li> <li>▪ Jeffrey met with NRCAN (DTI Canada) to discuss the Canadian adoption of the marine roadmap 31st Oct</li> </ul> <p><b>Photovoltaics</b></p> <ul style="list-style-type: none"> <li>▪ Visit to Singapore and Philippines, November 2007.</li> </ul> <p><b>Marine</b></p> <ul style="list-style-type: none"> <li>▪ Jeffrey met with EU to present the Marine roadmap in Brussels for possible EU adoption 12<sup>th</sup> Nov</li> <li>▪ Jeffrey met with NRCAN (DTI Canada) to discuss the Canadian adoption of the marine roadmap 31<sup>st</sup> Oct</li> </ul>
<b>I.5 Meetings international visitors</b>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 26 Nov Haszeldine, meeting with China ambassador for Clean Coal, Edinburgh</li> <li>▪ 28 Nov 2007 Haszeldine invited attendee, First International Carbon Capture Summit, City &amp; Financial, London</li> </ul> <p><b>Future Sources (General)</b></p> <ul style="list-style-type: none"> <li>▪ Winksel presented work on learning effects to delegation from Florida Atlantic University and Florida Power and Light Company, 23<sup>rd</sup> October.</li> </ul>
	<b>E. Regional/National Industry Engagement</b>
<b>E.1 Regional/ industrial participation in meetings</b>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 13 Nov (Wilkinson) Peterborough joint panel (engineers)</li> <li>▪ 28 Nov Haszeldine, poster presentation. Science in (Scottish) Parliament</li> </ul> <p><b>Future Sources (General)</b></p> <ul style="list-style-type: none"> <li>▪ Jeffrey attended the Scottish Renewables Forum Marine Energy seminar, 9<sup>th</sup> Oct</li> </ul>
<b>E.2 Links/ regional contact points</b>	<p><b>Future Sources (General)</b></p> <ul style="list-style-type: none"> <li>▪ Jeffrey and Winksel attended a 'Scotland's Energy Future' meeting, Scottish Parliament, 27<sup>th</sup> Sep</li> <li>▪ Jeffrey and Winksel attended the 'Science and the Parliament' on Energy and Climate Change, Edinburgh, 28<sup>th</sup> November</li> </ul>
<b>E.3 National Industry/ participation in meetings</b>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 10 Oct Haszeldine Technology matrix workshop. ERP and EPSRC, London</li> <li>▪ 15 Oct Haszeldine TSB Technology Programme, Carbon Abatement Technology. Panel Assessor, Harwell</li> <li>▪ 28 Nov 2007 Haszeldine invited attendee, First International Carbon Capture Summit, City &amp; Financial, London</li> </ul> <p><b>Future Sources (General)</b></p> <ul style="list-style-type: none"> <li>▪ Jeffrey attended the marine standards workshop 25<sup>th</sup> Sep</li> <li>▪ Jeffrey attended the Supergen Marine workshop 12<sup>th</sup> Oct</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Jeffrey, Winskel and other FSE theme members attended the Energy Research Partnership workshop on ERP's Technology Matrix, London, 10<sup>th</sup> Oct</li> </ul> <p><b>Marine</b></p> <ul style="list-style-type: none"> <li>▪ Wallace attended the ETI/EPSC meeting to scope the Call for Proposals in Marine and Offshore Wind, building off the UKERC Marine Roadmap.</li> <li>▪ Jeffrey and Winskel attended the UKERC 2050 internal workshop. 2<sup>nd</sup> Nov, London</li> </ul> <p><b>Photovoltaics</b></p> <ul style="list-style-type: none"> <li>▪ Attending ETI research strategy review organised by REP.</li> </ul>
<b>E.5 Other industrial engagement</b>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 10 Sept Haszeldine meet power industry</li> <li>▪ 13 Sept Haszeldine meet power industry</li> <li>▪ 3 Oct Markusson Zero Emissions Programme Ann Assembly, Paris</li> <li>▪ 9 Oct Haszeldine meet power industry</li> <li>▪ 11 Oct Haszeldine meet power industry</li> <li>▪ 29 Nov Haszeldine, meet power industry</li> </ul> <p><b>Marine</b></p> <ul style="list-style-type: none"> <li>▪ Mueller &amp; Jeffrey presented the UKERC Marine Roadmap and Landscape to a delegation from Alstom in November 2007.</li> <li>▪ Wallace &amp; Jeffrey presented Jeffrey presented the UKERC Marine Roadmap and Landscapes to delegations from Scottish Power and NPower Renewables in November</li> </ul>
	<b>PL. Policy Links</b>
<b>PL.1 Response to consultation, evidence given to Committees, etc</b>	<p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 17 Sept Haszeldine Advisory Committee on Carbon Abatement Technology BERR, London</li> <li>▪ 19 Sept Haszeldine Economy Energy and Environment Committee. Invited evidence, Scottish Parliament</li> <li>▪ 28 Nov Haszeldine, poster presentation. Science in (Scottish) Parliament</li> </ul> <p><b>Photovoltaics</b></p> <ul style="list-style-type: none"> <li>▪ Prepared evidence on renewavblea for Select Committee of Science and Technology. Attending meeting at UKERC with the Chair of the committee.</li> </ul>
	<b>C. Communication</b>
	<p><b>Bioenergy</b></p> <ul style="list-style-type: none"> <li>▪ Extensive coverage of current research on global change and forest ecosystems as sinks for additional carbon capture including articles in The Times, Independent, Report in Nature Geoscience and now an article on The Science Museum website.</li> <li>▪ Autumn Leaves Research Reported in Nature - this text should link to this <a href="http://www.nature.com/climate/2008/0801/full/ngeo.2007.61.html">http://www.nature.com/climate/2008/0801/full/ngeo.2007.61.html</a> Autumn Leaves Research is a story in 'The Science Museum' London - this text should link to this: <a href="http://www.sciencemuseum.org.uk/antenna/autumn/">http://www.sciencemuseum.org.uk/antenna/autumn/</a> Research hits the Daily Science paper - this text should link to this: <a href="http://www.sciencedaily.com/releases/2007/11/071117104404.htm">http://www.sciencedaily.com/releases/2007/11/071117104404.htm</a></li> </ul> <p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 20 Sept Haszeldine Carbon Capture and Storage. Chemistry world podcast</li> <li>▪ 6 Nov Science Media Centre, London. Invited media briefing on CCS</li> <li>▪ 7 Nov Reuters www CCS – Haszeldine quoted</li> </ul> <p>30 Nov Haszeldine BBC news filming Clean coal, aquifer storage CCS (released 4 Dec)</p>
	<b>F. Co-funding</b>
	<p><b>Bioenergy</b></p> <ul style="list-style-type: none"> <li>▪ Short =listed BBSRC Bid for the Bioenergy Research Centre, as part of the Porter Alliance</li> </ul> <p><b>Carbon Management</b></p> <ul style="list-style-type: none"> <li>▪ 1 Sept UKERC PhD studentship starts, Rudra Kapila 2007 -10</li> </ul>

	<p><b>Marine</b>  Supergen Marine Phase 2, Sept 2007, Outcomes of the project will feed into the UKERC Marine Roadmap.</p>
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## Energy Systems and Modelling

<b>July – Dec 2007</b>	<b>R. Research Programme Overview</b>	
<b>R.1</b>	Review of Milestones incl outputs	<p><b>1. Energy systems modelling.</b></p> <ul style="list-style-type: none"> <li>▪ Following publication of the UK Energy White Paper (May 2007) the UK MARKAL Macro model was used to test alternate decarbonisation scenarios including -80% CO<sub>2</sub> reductions and the inclusion of international aviation <ul style="list-style-type: none"> <li>○ This included work for DEFRA and a number of NGOs (WWF, IPPR, RSPB)</li> </ul> </li> <li>▪ The full documentation effort was completed with all chapters publicly available at <a href="http://www.ukerc.ac.uk/ResearchProgrammes/EnergySystemsandModelling/ESM.aspx">http://www.ukerc.ac.uk/ResearchProgrammes/EnergySystemsandModelling/ESM.aspx</a></li> <li>▪ A temporally disaggregated version of the MARKAL model was completed and used to investigate the role of energy storage</li> <li>▪ A spatially disaggregated version of the model with a GIS interface was completed and used to investigate the costs and role of hydrogen infrastructures</li> <li>▪ A policy paper on global and national energy scenarios was completed for the UK-Japan LCS research project</li> <li>▪ A modelling paper on international drivers of UK energy scenarios was completed for the UK-Japan LCS research project</li> <li>▪ Technical updates to the MARKAL model, combined with implementation of demand side elasticities was completed in readiness for the UKERC 2050 project</li> <li>▪ Co-ordination with various working groups on Energy markets, Technological progress, Energy demands and Energy policy are ongoing as part of the UKERC Energy 2050 project.</li> </ul> <p><b>2. Top down economic modelling</b></p> <ul style="list-style-type: none"> <li>▪ Work is progressing on model development within MDM-E3 <ul style="list-style-type: none"> <li>○ The energy technology model represents endogenous technological change and technology learning rates have been incorporated</li> <li>○ A full set of energy efficiency policies has been implemented</li> <li>○ The energy demand sub-model has been extended and incorporated</li> <li>○ Household energy sub-model has been completed and incorporated</li> <li>○ Transport energy sub-model is in a working version</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>○ Additional work on the econometric estimation of passenger transport fuel economy has been completed.</li> <li>▪ Completion of documentation and working papers for sub-models</li> <li>▪ Co-ordination with various working groups on Energy markets, Technological progress, Energy demands and Energy policy are ongoing as part of the UKERC Energy 2050 project.</li> </ul> <p><b>3. Integration of top-down and bottom-up energy modelling approaches:</b></p> <ul style="list-style-type: none"> <li>▪ Development of the current MDM-E3 sub-models, as described above</li> <li>▪ Completion and calibration of 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 Energy Journal on '<i>Hybrid Modelling of Energy-Environment Policies: reconciling bottom-up and top-down</i>'.</li> </ul> <p><b>4. Networking and Co-ordination</b></p> <ul style="list-style-type: none"> <li>▪ The revised version of the ESM webpage was completed – see <a href="http://www.ukerc.ac.uk/ResearchProgrammes/EnergySystemsandModelling/ESM.aspx">http://www.ukerc.ac.uk/ResearchProgrammes/EnergySystemsandModelling/ESM.aspx</a></li> <li>▪ 12 papers on low carbon societies (LCS) were coordinated as a special journal issue (Climate Policy) as input to the G8 process on climate mitigation.</li> </ul>
<p><b>R.2</b></p>	<p>Progress against plan (brief narrative highlighting progress/changes from planned activity)</p>	<p>As discussed in section R1, the ESM theme is closely progressing along its planned goals (see below). Deviation from this timeline have occurred due to researchers taking advantage of major policy and research opportunities. These have included extensive public policy use of the MARKAL model in the UK Energy White Paper, coordination by 4CMR researchers of key chapters in the IPCC's 4<sup>th</sup> Assessment report, the UK-Japan LCS project on low carbon societies to feed into the G8 discussions during the Japanese presidency in 2008. and a major project for DEFRA on the rebound effect in energy efficiency uptake.</p> <p>Energy systems modelling (with a completed UK MARKAL model and its variants) is now refocusing on academic and other research publications. Macro-economic modelling efforts (with substantial progress on incorporating the energy technology and other bottom up sub-modules) is similarly refocusing on research outputs including the capacity for uncertainty analysis to be incorporated into the latest version of MDM-E3. Top-down bottom-up modelling work is following up the UK modelling extensions with a review paper on international efforts on hybrid modelling. Finally, network and co-ordination is a strength of the theme with a UK coordination role through UKERC, HeedNet and BIEE and strong international links within IEA, ETSAP, IPCC and among other consortia.</p>

	<p><b>Planned Work</b></p>	<p>2008 work will also be driven by the major UKERC integrating project: Energy 2050 in which ESM is playing a key analytical role</p> <ol style="list-style-type: none"> <li>1. <i>UK MARKAL modelling:</i> <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> <li>▪ Significant analytical input into key energy policy debates.</li> <li>▪ Further research and academic applications</li> </ul> </li> <li>2. <i>UK macro-econometric modelling:</i>  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. <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> <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> </li> <li>3. <i>Integration of top-down and bottom-up energy modelling approaches</i></li> <li>4. <i>Networking and Co-ordination</i> <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> </li> </ol>
<p><b>R.3</b></p>	<p>Plan for coming 6 months (activities, output)</p>	<ul style="list-style-type: none"> <li>▪ Extensive modelling of core and variant scenarios under UKERC Energy 2050 <ul style="list-style-type: none"> <li>○ Including the Annual energy modelling conference (AEMC) 07/08 for wider expert and stakeholder involvement</li> <li>○ Including working papers on integrating climate and security scenarios</li> <li>○ Including a working paper reviewing UK energy scenarios</li> </ul> </li> <li>▪ A series of academic publications using the MARKAL model including long term energy system evolution, biomass, hydrogen infrastructures, and temporal operation of the electric sector</li> <li>▪ Additional academic papers on macro-econometric modelling</li> <li>▪ Modelling collaboration on low carbon societies, including the 3<sup>rd</sup> UK-Japan LCS workshop in Feb 08 and publication of a special issue on LCS in the journal Climate Policy for the Japanese hosted G8</li> </ul>



		<p>summit</p> <ul style="list-style-type: none"> <li>▪ Implementation of capacity for uncertainty analysis into MDM-E3</li> <li>▪ Working paper on hybrid modelling approaches</li> <li>▪ Attendance a number of key energy-economic conferences (e.g. IAEE)</li> </ul> <p>Note: The PSI energy systems modelling team will be moving to Kings College London (KCL)</p>
<b>July – Dec 2007</b>	<b>P. Publications</b>	
<b>P.1 Journal Articles</b>	<ul style="list-style-type: none"> <li>▪ Barker, Terry, Sudhir Junankar, Hector Pollitt and Philip Summerton 'Carbon leakage from unilateral environmental tax reforms in Europe, 1995-2005', Energy Policy 35 (2007) 6281–6292</li> <li>▪ Barker, Terry and Jonathan Rubin 'Macroeconomic effects of climate policies for road transport: Efficiency agreements versus fuel taxation for the UK, 2000-2010' Proceedings of the Transportation Research Board, Washington DC, 2007.</li> <li>▪ Barker, T S, Ekins, P and Foxon, T J, (2007) 'The macroeconomic rebound effect and the UK economy', Energy Policy, Vol.35 No.10, October, pp. 4935-4946.</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', Energy Economics, special issue 'Modelling of industrial energy consumption', Vol.29 No.4, pp.760-778</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', Climate Policy (in press)</li> <li>▪ Bonilla, D and Foxon, T, 'The Demand for New Car Fuel Economy of Gasoline and Diesel in the UK'. Journal of Transport Economics and Policy (submitted)</li> <li>▪ Strachan, N and Kannan, R (2007) Hybrid Modelling of Long-Term Carbon Reduction Scenarios for the UK, Energy Economics (submitted)</li> <li>▪ Kannan R. and Strachan N. (2007) Comparison of long-term final energy demand and CO2 emissions projection – analysis from the UK MARKAL and other housing stock models, Applied Energy (submitted)</li> <li>▪ Strachan, N, S. Pye and N. Hughes (2007) International Drivers of a UK Evolution to a Low Carbon Society, Climate Policy (submitted)</li> <li>▪ Strachan, N, T, Foxon, and J Fujino (2007) Policy implication from modelling long term scenarios for low carbon societies, Climate Policy (submitted)</li> </ul>	
<b>P.2 Books/ Books Chapters</b>	<ul style="list-style-type: none"> <li>▪ P. Ekins, N Strachan et al (2007) SEEC International handbook on the economics of energy The Structure and Use of the UK MARKAL Model</li> </ul>	
<b>P.3 Reports/ Conference papers/presentations/working papers/meetings reports</b>	<ul style="list-style-type: none"> <li>▪ Barker T et al, IPCC 4AR Mitigation report</li> <li>▪ Barker T et al, IPCC 4AR synthesis report</li> <li>▪ Strachan, N, N. Balta-Ozkan, R. Kannan, N. Hughes, K. McGeevor, D. Joffe (2007) State-of-the-art modelling of hydrogen infrastructure development for the UK: Geographical, temporal and technological optimisation modelling, Final Report on Modelling Methodology and Modelling Outputs for Department for Transport, London</li> <li>▪ Kannan R. (2007) Overview of the UK MARKAL Energy System Model, Presented to the CaRB project team, University College London, 19 July 2007</li> <li>▪ Ekins, P. 2007 'The UK MARKAL Model: Structure, methodology, key input parameters scenarios, results, sensitivities', presentation to the Ashden Trust, July 3<sup>rd</sup> 2007</li> <li>▪ Barker T (2007) 'Avoiding dangerous climate change' HEEDNET meeting.</li> <li>▪ Strachan N. (October 2007) The Role of CCS in Long-Run UK Decarbonisation Scenarios, DBERR Schlumberger Zero carbon energy technology workshop, Crawley</li> </ul>	

	<ul style="list-style-type: none"> <li>▪ Ekins P. (November 2007) Policy drivers for the UKERC Energy 2050 project, London</li> <li>▪ Ekins, P. 2007 'The UK MARKAL Model: Structure, methodology, key input parameters, and relevance to bioenergy', presentation to the SUPERGEN Bioenergy Consortium, November 7th 2007</li> <li>▪ Ekins, P. 2007 'The UK MARKAL Model: Structure, methodology, key input parameters scenarios, results, sensitivities', presentation to DEFRA, November 13<sup>th</sup> 2007</li> </ul>
	<b>N. Network Co-ordination</b>
<b>N.3 Theme meetings engaging those external to UKERC</b>	<ul style="list-style-type: none"> <li>▪ WWF, IPPR, WSPB – deep CO2 reduction scenarios and modelling for the UK</li> <li>▪ University College London (Mark Barrett, Harry Bruhns) – Modelling buildings energy</li> <li>▪ Bio energy Research Forum, Biomass CHP</li> </ul>
	<b>O. Research Opportunities</b>
<b>O.1 Research Atlas: landscapes</b>	<ul style="list-style-type: none"> <li>▪ Updated energy systems analysis landscape of UK expertise – <a href="http://ukerc.rl.ac.uk/ERL001.html">http://ukerc.rl.ac.uk/ERL001.html</a></li> </ul>
	<b>I. International Engagement</b>
<b>I.2 Conferences Workshops for which UK attendance facilitated</b>	<ul style="list-style-type: none"> <li>▪ iTREN-2030 Workshop, Integrated transport and energy baseline until 2030</li> </ul>
<b>I.3 Participation in international initiatives</b>	<ul style="list-style-type: none"> <li>▪ Ongoing strategic collaborations with US EPA modelling group</li> <li>▪ Observer status on International Energy Agency (IEA) ETP2008 modelling and publication</li> <li>▪ ESM is the core organiser 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. 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> </ul>
<b>I. 4 Overseas visits</b>	
<b>I.5 Meetings with international visitors</b>	<ul style="list-style-type: none"> <li>▪ Gary Goldstein, ETSAP primary systems coordinator</li> </ul>
	<b>E. Regional/National Industry Engagement</b>
<b>E.1 Regional/industrial participation in meetings</b>	<ul style="list-style-type: none"> <li>▪ DBERR Schlumberger Zero carbon energy technology workshop, October 2007</li> </ul>
	<b>PL. Policy Links</b>
<b>PL.1 Response to consultation, evidence given to Committees, etc</b>	Series of meetings with key climate-energy-economics representatives in the Office for Climate Change, (OCC), DBERR and DEFRA following the departmental reshuffle
	<b>F. Co-funding</b>

	£84,000- EON-EP SRC: Transition pathways to a low carbon economy
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## Environmental Sustainability

<b>July – Dec 2007</b>	<b>R. Research Programme Overview</b>	
<b>R.1</b>	Review of Milestones incl outputs	LCA work in progress but taking longer than anticipated, given the vast literature in this area. New work on energy2050 is underway, contributing to the supply working group.
<b>R.2</b>	Progress against plan (brief narrative highlighting progress/changes from planned activity)	<p>In the last six months within the ES theme we have appointed a University of Southampton graduate, Jennifer Chapman who has been contributing to the LCA systematic analysis on bioenergy with Rebecca Rowe, analysing up 1000 research papers and articles on bioenergy LCA, using a predefined set of criteria, for comparison with other renewable energy sources. This forms part of the UKERC integrated project on LCA. This activity has taken longer than planned given the vast amount of literature on the topic.</p> <p>Jen Chapman has undertaken an update of UKERC webpages on bioenergy. We have written articles for the En Agri industry on-line journal and for British Bioenergy, as well as negotiating a new joint 'branding' and input into this specialist magazine which has a circulation in excess of 2,000</p> <p>We have contributed to the two integrating research projects Energy 2050 and Learning rates and technology developments providing expert input on bioenergy. This will be on-going.</p> <p>The draft roadmap is nearly complete and should be out for review in January 2008.</p> <p>Activity in this area has remained high with several interactions with the media including plans for a Countryfile National TV slot, appearance on 'You and Yours' Radio 4, September 2007 on Sustainability of biofuels and on BBC Radio Northern Ireland, Radio Scotland, Radio 5 live to talk about climate change impacts on trees. This latter research was featured in The Independent, The Times, Nature Geoscience, The Science Daily and is now an item on 'The Science Museum' website for youngsters.</p>

R.3	Plan for coming 6 months (activities, output)	<ul style="list-style-type: none"> <li>▪ Working paper on the limitations of life-cycle analysis for assessing environmental sustainability of energy technologies (collaboration with other ES topics and FSE) in progress. Target date Spring '08.</li> <li>▪ Manuscript on limitations of life-cycle analysis for assessing energy balance of liquid biofuels and biomass. Target date: Summer 08.</li> <li>▪ Complete the systematic review of LCA on bioenergy and develop journal paper on heat, power and liquid transportation biofuels in collaboration with CEH.</li> <li>▪ In January 2008 we will begin some new work on assessing the UK land resource for bioenergy crop deployment, using a GIS approach and following on from the research of Mat Aylott in the laboratory.</li> </ul>
July – Dec 2007	<b>P. Publications</b>	
P.1 Journal Articles	<ul style="list-style-type: none"> <li>▪ Identifying potential environmental impacts of large-scale deployment of dedicated bioenergy crops in the UK In Press, Uncorrected Proof, <i>Available online 4 September 2007, Renewable and sustainable energy reviews.</i> Rebecca L. Rowe, Nathaniel R. Street and Gail Taylor.</li> <li>▪ Yield and spatial supply of bioenergy poplar and willow short rotation coppice in the UK. Matthew J. Aylott, E. Casella, I. Tubby, N.R. Street, I. Tubby , N. R. Street , P. Smith &amp; Gail Taylor <i>New Phytologist, In Press.</i></li> <li>▪ Identifying potential environmental impacts of large-scale deployment of dedicated bioenergy crops in the UK. Rebecca L. Rowe, Nathaniel R. Street and Gail Taylor, <i>Renewable and Sustainability Energy Reviews, In Press.</i></li> <li>▪ UKERC Bioenergy-current activity. Gail Taylor, <i>British Bioenergy News, In Press</i></li> <li>▪ Can biofuels be sustainable? EnAgri on-line information source for the industry, Jennifer Chapman</li> </ul>	
P.3 Reports/ Conference papers/presentations/working papers/meetings reports	<ul style="list-style-type: none"> <li>▪ 09/10/2007. S. Holloway. CO2 sources and sinks in the UK, Keynote presentation at Gasification 8 - Effective Carbon Control Conference, Hilton Hotel, Antwerp.</li> <li>▪ 12/09/2007. S.Holloway. Storage options for CO2 in the UK, Presentation at Synnogy New Energy Forum, Inmarsat Conference Centre, London.</li> <li>▪ 11th September 2007 D Howard Tidal power from the Solway Firth; barriers, impacts and capacity British Hydropower Association annual conference</li> <li>▪ The Carbon Trust-UKERC meeting 'The Bioenergy Directed Research project' Presented UK Bioenergy Research – current status and future prospects, Nov, 2007, Oxford. G. Taylor.</li> <li>▪ UK-Singapore Renewable Energy technology workshop joint with A star Singapore presented 'UK Bioenergy Research – current status and future prospects, Singapore, November 2007.</li> <li>▪ UK -Philippines Workshop with the Agricultural Society of Philippines, presented 'UK Bioenergy and environmental sustainability of biofuels', November 2007, Manila.</li> <li>▪ University of Nottingham, Departmental Seminar, ; Sustainable Bioenergy? Presented Sutton Bonington, December 2007.</li> </ul>	
P.4 Other	<ul style="list-style-type: none"> <li>▪ David Howard was panellist at BES Energy Debate, Glasgow 10<sup>th</sup> September 2007</li> </ul>	
	<b>N. Network Co-ordination</b>	
N.3 Theme meetings engaging those	<ul style="list-style-type: none"> <li>▪ The Carbon Trust Bioenergy Accelerator Project is a new research project to be funded by CT. A meeting will be held at The Meeting Place November 2007, organised by MP, CT and Gail Taylor, to help provide guidance and ideas for</li> </ul>	

<b>external to UKERC</b>	<p>project proposals in this area</p> <ul style="list-style-type: none"> <li>▪ UKERC Energy 2050 meetings in London (24th October and 4th December 2007)</li> <li>▪ LCA – Life cycle analysis systematic review is being undertaken in collaboration with TSEC-BIOSYS activity in this area. Meeting organised in December.</li> </ul>
	<b>O. Research Opportunities</b>
<b>O.1 Research Atlas: landscapes</b>	<ul style="list-style-type: none"> <li>▪ “Strategies and roadmaps for sustainable energy use for Transport” uploaded to UKERC website, including 9 roadmap characterisations (November 07).</li> <li>▪ Working paper “Towards Sustainable energy use for transport” uploaded to UKERC web-site (Sept 07)</li> <li>▪ Discussions with Paul Upham and Patricia Thornley from Tyndall Manchester over Life Cycle Assessments for biofuels.</li> <li>▪ Research atlas for bioenergy updated, peer reviewed and on-line</li> </ul>
<b>O.2 Research Atlas: roadmaps</b>	<ul style="list-style-type: none"> <li>▪ Participation in the Carbon Trust’s Oxford meeting Bioenergy directed research: opportunities for the Carbon Trust &amp; the bioenergy community 12-13 November 2007</li> <li>▪ Roadmap for bioenergy. Working paper on Oxford meeting completed and on UKERC website. Draft roadmap near to completion.</li> </ul>
	<b>I. International Engagement</b>
<b>I.1 Confer/workshops organised</b>	<ul style="list-style-type: none"> <li>▪ International symposium, Society For experimental Biology’, planned for July 2008 ‘Energy from Green Plants’</li> <li>▪ The Carbon Trust workshop on The neww’Directed Research’ competition that aims to spent up to £10 million on Bioenegry Research. UKERC Meeting Place organised the meeting with ES input, November 2007. Presentation ‘Bioenergy UK – current status and future prospects’.</li> </ul>
<b>I.2 Confer/Workshops for which UK attend. facilitated</b>	<ul style="list-style-type: none"> <li>▪ Participation in the UK-Singapore and UK-Philippines workshops organised by the UK embassy and High Commission in collaboration with A star Singapore and the Agricultural Society of the Philippines, Singapore and Manila, November 2007. Presentation in Philippines on sustainable biofuels and contacts made thereafter to discuss joint collaboration and potential funding for new projects</li> <li>▪ Participation in workshop on FP 7 current Energy calls, December 2007, Brussels.</li> </ul>
<b>I.3 Part. intertional initiatives</b>	<ul style="list-style-type: none"> <li>▪ FPVII project ‘ENERGY POPLAR’ ranked first for funding 2008</li> </ul>
<b>I. 4 Overseas visits</b>	<ul style="list-style-type: none"> <li>▪ Luke Reade attended the 7th European Wave and Tidal Energy Conference, Porto, Portugal 11-13 September 2007</li> </ul>
	<b>E. Regional/National Industry Engagement</b>
<b>E.1 Reg/Industrial participat meetings</b>	<ul style="list-style-type: none"> <li>▪ Participation in focus groups with regional supply consortia for biomass to discuss the supply chain for bioenergy demand, Devon, November 2007, organised by TV Energy as part of the TSEC-BIOSYS project.</li> </ul>
<b>E.2 Links with regional contact points</b>	<ul style="list-style-type: none"> <li>▪ David Williams (British Hydropower Association) and John Aldrick (Environment Agency) 3<sup>rd</sup> September 2007</li> <li>▪ Battelle discussions over fuel additives and bus fleets 12<sup>th</sup> September 2007</li> </ul>
<b>E.3 National Industrial participati meetings</b>	<ul style="list-style-type: none"> <li>▪ Luke Reade attended the Marine renewable Energy Conference, London, 21 September 2007</li> <li>▪ Participation, December 2007, NIAB (National Institute for agricultural Botany), Cambridge on ‘Future trials for bioenergy SRC and Miscanthus crops’ sponsored by DEFRA and including wide consultation. Input provided on poplar</li> </ul>

	<p>as a bioenergy crop.</p> <ul style="list-style-type: none"> <li>Participated in meeting organised by Forestry Commission, 'Forests and Climate Change' London, November 2007.</li> </ul>
<b>E.4 Links with national contact points</b>	<ul style="list-style-type: none"> <li>The Bioenergy Funders Forum is a UK group of all Government Departments that fund research into bioenergy. G Taylor attends the annual meeting and the group has just released the 'Research Priorities' paper, available on the DEFRA website, which GT had input.</li> <li>Sam Holloway advisor to DBERR on their Competition for support for a full chain demonstration of CCS in the UK, see demo web site at <a href="http://www.berr.gov.uk/energy/sources/sustainable/carbon-abatement-tech/ccs-demo/page40961.html">http://www.berr.gov.uk/energy/sources/sustainable/carbon-abatement-tech/ccs-demo/page40961.html</a></li> </ul>
<b>E.5 Other industrial engagement</b>	<ul style="list-style-type: none"> <li>Participated in expert panels for bioenergy, wind and hydro power in selecting winners for the Rushlight Awards.</li> <li>Attended Renewable Energy Association annual meeting on Bioenergy, Oxford, September, 2007</li> </ul>
	<b>PL. Policy Links</b>
<b>PL.1 Response consulta, evidence given to Committee etc</b>	<ul style="list-style-type: none"> <li>26/9/07 Response to EAC inquiry "Are Biofuels Sustainable" and Taylor G. Evidence to the Audit Commission consultation , Biofuels – can they be sustainable?' September 2007</li> <li>Sept 07 Response to consultation for "King Review of Low Carbon Transport"</li> </ul>
	<b>C. Communication</b>
<b>C.4 Media Coverage</b>	<ul style="list-style-type: none"> <li>Taylor G and Rowe, R , June 2007, Meridian TV, broadcast on Bioenergy from an Oxfordshire Farm</li> <li>Invitation to appear on 'Countryfile' a National TV programme dealing with rural and farming issues to discuss environmental sustainability of biofuel crops in the UK and globally.</li> <li>Wide media coverage of research on climate change and trees including Radio 5 live, Radio Scotland, Radio Northern Ireland, The Independent, The Times, Nature Geoscience, The British Museum, The Science Daily, on the impact of rising CO<sub>2</sub> on leaf fall.</li> </ul>
	<b>F. Co-funding</b>
<b>F.1</b>	<ul style="list-style-type: none"> <li>An new FP7 project won 'BRIDGE' which will focus on the sustainability of urban environments including the sustainability of energy and the ability of renewable energy to meet supply requirements.</li> </ul>

## Materials for Advanced Energy Systems

<b>July – Dec 2007</b>	<b>R. Research Programme Overview</b>	
<b>R.1</b>	Review of Milestones incl outputs	<ul style="list-style-type: none"> <li>There has been slow steady progress in the last six months, partly due to the PDRA, Dr F. Rataboul leaving to take up an academic position in France. This has led to a break in PDRA work. However, several structural studies were carried out on the silsesquioxane molecules that were being used as models for the cores of metal organic frameworks. This study was done in conjunction with Prof. D.</li> </ul>

		<p>Rankin and Dr. S. Masters at the University of Edinburgh and the results will be published in 2008. Several new compounds for hydrogen uptake studies have been prepared and our first studies have been carried out in collaboration with the hydrogen group led by Dr Book at the University of Birmingham. This has given us our first lead compound, derived from picolinic acid, that absorbs about 1.2 weight % hydrogen even at the modest pressure of 2 atm.</p> <ul style="list-style-type: none"> <li>▪ Finished the design of a complicated tiny photoelectronchemical cell combined with laser system.</li> <li>▪ After discussing with several companies, a micro GC analytic system has been ordered for our future accurate measurement of H<sub>2</sub> and O<sub>2</sub> production.</li> <li>▪ Attend one Platform held by EPSRC in Oxfordshire in Nov.</li> <li>▪ Initial results demonstrating feasibility of simulation charge transport in disordered organic solids; methodology developed for structural simulations and quantum chemical calculations.</li> <li>▪ First large area photovoltaic devices fabricated using printing and spray-gun techniques</li> </ul>
<b>R.2</b>	Progress against plan (brief narrative highlighting progress/changes from planned activity)	<ul style="list-style-type: none"> <li>▪ The preparation of Metal organic frameworks using silsesquioxane linkers has proved more difficult than anticipated and so, while this work continues, we are also looking at new linkers containing malonate groups with which to link metals. We have also moved away from preparation of linking molecules containing thione groups, again due to difficulties in their synthesis.</li> <li>▪ A patent draft about efficient oxidation of stable organics is being prepared.</li> <li>▪ One paper is ready and will be submitted to JACS as soon as the patent is filled.</li> <li>▪ However, new/modified materials were not made because we have not have time to do it. Probably we will collaborate with the other researchers to complete it.</li> <li>▪ Charge transport simulations to date have demonstrated on necessity for better sampling (larger models); focus shifted towards developing faster methods to allow this.</li> </ul>
<b>R.3</b>	Plan for coming 6 months (activities, output)	<ul style="list-style-type: none"> <li>▪ We plan to concentrate on making new malonate linkers for the formation of MOFs, to prepare new silsesquioxanes containing carboxylic acid and pyridyl functions for MOF formation. We also plan to continue with the study of MOFs in collaboration with the Birmingham group and to make new measurements on surface areas using equipment in the Chemical Engineering Department at Imperial College. Importantly, a new PDRA to replace Dr Rataboul should be in post in early January and this should accelerate work significantly</li> <li>▪ Jan. 2008, two new setups will be built in our lab simultaneously, which include <ol style="list-style-type: none"> <li>1) an on-line real time H<sub>2</sub> and O<sub>2</sub> evaluation system;</li> <li>2) photoelectrochemical water splitting system using different bias to separate electrons and</li> </ol> </li> </ul>

		<p>holes in semiconductor films.</p> <ul style="list-style-type: none"> <li>▪ Mar, 2008, a four flash lamp system will be built to simulate the O<sub>2</sub> production process and find the key points which determined O<sub>2</sub> reaction rate.</li> <li>▪ Extend charge transport simulations to exciton diffusion (in collaboration with BASF)</li> <li>▪ Begin in-house simulation of small-molecule film morphology and compare with existing methods (in collaboration with the University of Karlsruhe)</li> <li>▪ Adapt new and faster quantum chemical software to electronic characterisation of film morphologies</li> </ul>
<b>July – Dec 2007</b>	<b>P. Publications</b>	
<b>P.4 Others</b>	<ul style="list-style-type: none"> <li>▪ Dr S Skinner gave an invited seminar at the University of Aberdeen, Dec 2007.</li> <li>▪ Dr S Skinner gave an invited seminar at the Queen Mary, Univ London, Sept. 2007.</li> </ul>	
	<b>I. International Engagement</b>	
<b>I.4 Overseas visits</b>	Dr S Skinner participated in the UKERC sponsored visit to Singapore and Manila, Nov 25-30 2007.	
<b>I.5 Meetings with international visitors</b>	<p>Dr S Skinner met with Dr Sutin Kuharuangrongand Dr Sumittra Charojrochkul, visitors from Thailand.</p> <p>Dr S Skinner met with Dr Olga Smirnova, Yamanashi University, Japan</p> <p>Dr S Skinner met with Dr Natalia Skorodumova, Uppsala University</p>	

## Meeting Place

<b>January – June 2007</b>	<b>R. Research Programme Overview</b>	
<b>R.1</b>	Review of Milestones incl outputs	See below.
<b>R.2</b>	1. Progress against plan (brief narrative highlighting progress/changes from planned activity.	<p><b>July 2007-December 2007</b></p> <ul style="list-style-type: none"> <li>▪ 18th-19th July: "SUPERGEN workshop" (delivered)</li> <li>▪ 19th-20th September: China/US/UK carbon capture and storage workshop – cancelled by proposer Jon Gibbins as no longer appropriate/relevant</li> <li>▪ 25th September: "The Energy White Paper: An academic critique" one-day seminar in collaboration with the BIEE (delivered)</li> <li>▪ 15th-16th October: "Agent Based Modelling: Application to energy policy" (delivered)</li> <li>▪ 30th October: "The cost-effectiveness of carbon abatement in the transport sector" (delivered)</li> <li>▪ 12th-13th November: "Bioenergy Directed Research: opportunities for the Carbon Trust &amp; the bioenergy community" in collaboration with the Carbon Trust (delivered – not in original plan)</li> <li>▪ 23rd November: "Tourism in a low carbon world"</li> </ul>



		<p>in collaboration with Natural England.</p> <ul style="list-style-type: none"> <li>▪ Autumn: Smart integrated metering for households in collaboration with the Sustainable Development Commission (postponed to Spring 2008 as proposer SDC not decided on organisational priorities)</li> <li>▪ 4th-5th December: Annual Energy Modelling Conference (postponed to 30th-31st January 2008 as proposers need more time to develop ideas)</li> </ul>
<p><b>R.3</b></p>	<p>Plan for coming 6 months (activities, output)</p>	<p><b>January 2008 – June 2008</b></p> <ul style="list-style-type: none"> <li>▪ 16th January: “New approaches to modelling behaviour change: Application to energy policy”, ½ day seminar, London. Follow-up to 15/16 October workshop – participants to present research proposals to potential funders and users. Output: meeting report and possible calls for proposals, interest in funding proposals and use of ABM models in policy development/design.</li> <li>▪ 30th-31st January: Annual Energy Modelling Conference, “Scenario definition, quantification and modelling. UKERC energy 2050: Moving towards a resilient, low carbon energy system.” Annual UKERC ESMT conference – Energy 2050 being the focus. Output: meeting report and published papers (journals or book).</li> <li>▪ 4th and 5th February: “Critical issues in UK carbon energy innovation policy”, in collaboration with the Sussex Energy Group, SPRU. Interdisciplinary and multistakeholder. Output: meeting report, policy-focussed document, input into SPRU research project.</li> <li>▪ March/April: Smart integrated metering for households (no longer in collaboration with the Sustainable Development Commission but with their support and might be championed by Oxford University). 2-day residential workshop, multistakeholder and interdisciplinary. Output: meeting report and policy-focussed document.</li> <li>▪ March/April: Communicating climate change and energy/carbon reduction – exchanging lessons learned, 2-day residential workshop in collaboration with UEA/Tyndall, 2 x 2-day residential workshops (follow-up workshop in autumn 08), location tbc. Multistakeholder and interdisciplinary. Outputs: meeting reports, practitioner and policy-focussed document; and jointly authored papers for special issue of journal or book.</li> <li>▪ 4th-8th May: International Network on Offshore Renewable Energy student conference, week long conference, Scotland. Interdisciplinary. Output: meeting report and possibly jointly authored papers for journals.</li> <li>▪ 13th-14th May: “Sustainable energy UK: Meeting the science and engineering challenge”, 2-day conference, Oxford. Interdisciplinary – mainly academics but will involve business/industry</li> </ul>

		<p>representatives. Output: posters and papers, latter to be clustered and published in special issues of journals.</p> <ul style="list-style-type: none"> <li>▪ 21-23rd May: "Managing residential electricity demand: Learning from experience in the UK and Ontario," 2 to 3 day residential workshop, multistakeholder and interdisciplinary, Oxford. Outputs: meeting report, policy-focussed summary, and published joint papers (in journals).</li> <li>▪ 1st June: Microgrids stakeholder workshop, half-day seminar, international research group to present draft "Microgrids" book that Meeting Place has helped coordinate. Mainly academics but possibly some industry/business representation. To be held in Greece in between two major Microgrid related conferences. Output: critique of chapters, publication of book with Springer.</li> <li>▪ 23rd-27th June: UKERC summer assembly and summer school, Roehampton. Outputs: meeting reports and training for students</li> </ul>
<b>N. Network</b>		
N.2	Meeting Place events	<p>From July 07 – Dec 07:</p> <ul style="list-style-type: none"> <li>▪ 18<sup>th</sup>-19<sup>th</sup> July: "SUPERGEN workshop" <ul style="list-style-type: none"> <li>○ 2 day residential workshop, interdisciplinary</li> <li>○ 33 attendees from different Supergen consortia (UK academics including some students, plus industry representatives)</li> <li>○ Outputs: meeting report; initiative to set up Supergen Coordination Committee; initiative to publish Supergen book covering relevant technology areas for PHD students/young researchers; commitment to larger workshop for sharing of key research findings from RCEP/Supergen research programmes.</li> <li>○ Report complete and available on UKERC website  <a href="http://www.ukerc.ac.uk/TheMeetingPlace/Activities/Activities2007/0707Supergen.aspx">http://www.ukerc.ac.uk/TheMeetingPlace/Activities/Activities2007/0707Supergen.aspx</a></li> </ul> </li> <li>▪ 25<sup>th</sup> September: "The Energy White Paper: An academic critique" one-day seminar in collaboration with the BIEE . <ul style="list-style-type: none"> <li>○ In collaboration with BIEE</li> <li>○ Multistakeholder and interdisciplinary</li> <li>○ 1-day seminar, London.</li> <li>○ Output: Meeting report  <a href="http://www.ukerc.ac.uk/TheMeetingPlace/Activities/Activities2007/0709BIEE.aspx">http://www.ukerc.ac.uk/TheMeetingPlace/Activities/Activities2007/0709BIEE.aspx</a></li> <li>○ Approx 85 delegates from different disciplines and professions – including good representation from business/industry/Government</li> </ul> </li> <li>▪ 15<sup>th</sup>-16<sup>th</sup> October: "Agent Based Modelling: Application to energy policy" <ul style="list-style-type: none"> <li>○ 2-day facilitated residential workshop, Oxford.</li> <li>○ Approx 25 participants, interdisciplinary – mainly academics</li> </ul> </li> </ul>

		<p>(some Gvt officials), ABM modellers and energy researchers who do not usually interact/network</p> <ul style="list-style-type: none"> <li>○ Outputs: Meeting report; 6 research proposals; commitment to follow-up workshop in January 2008</li> <li>○ Report: <a href="http://www.ukerc.ac.uk/TheMeetingPlace/Activities/Activities2007/0710ABM.aspx">http://www.ukerc.ac.uk/TheMeetingPlace/Activities/Activities2007/0710ABM.aspx</a></li> </ul> <ul style="list-style-type: none"> <li>▪ 30<sup>th</sup> October: "The cost-effectiveness of carbon abatement in the transport sector" <ul style="list-style-type: none"> <li>○ Half-day policy-focussed seminar, interdisciplinary and multi-stakeholder, London.</li> <li>○ Around 35 participants, mainly senior academics and Government officials.</li> <li>○ Outputs: meeting report; input into upcoming UKERC TPA study; possible follow-up research initiative. Report currently being finalised/approved.</li> </ul> </li> <li>• 12<sup>th</sup>-13<sup>th</sup> November: "Bioenergy Directed Research: opportunities for the Carbon Trust &amp; the bioenergy community" in collaboration with the Carbon Trust (delivered – not in original plan) <ul style="list-style-type: none"> <li>○ 2-day residential facilitated workshop, interdisciplinary and multi-stakeholder, Oxford.</li> <li>○ Around 50 attendees – UK academics and business/industry representatives.</li> <li>○ Co-sponsored by the Carbon Trust (50% of event costs)</li> <li>○ Outputs: Meeting report (available shortly); around 6 fully developed research proposals; Carbon Trust to follow-up with call for proposals in 2008.</li> </ul> </li> <li>▪ 23<sup>rd</sup> November: "Tourism in a low carbon world" <ul style="list-style-type: none"> <li>○ In collaboration with Natural England (who sponsored pre-workshop work carried out by Carey Newson)</li> <li>○ One day facilitated workshop, multi-stakeholder and interdisciplinary, London.</li> <li>○ Around 25 participants: academics, Government officials, tourism sector representatives, NGOs, business.</li> <li>○ Outputs: Meeting report (to be available shortly); many policy ideas (around 10 developed in detail); research requirements identified; suggestions for further meetings/workshops.</li> </ul> </li> </ul>
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## Technology and Policy Assessment

<b>July – Dec 2007</b>	<b>R. Research Programme Overview</b>	
<b>R.1</b>	Review of Milestones incl outputs	Major project on the 'rebound effect' completed and published. Launch events held 31 <sup>st</sup> October for media and general audiences. Wide media coverage – see below.
<b>R.2</b>	Progress against plan (brief narrative highlighting progress/changes from planned activity)	<p>The Rebound Project, as advised in previous reports, was significantly delayed but now completed (see above and below).</p> <p>The next project entitled 'What projects are most effective at Reducing Carbon Emissions from Transport' is well underway with the scoping note published, external consultants and academic collaborators engaged, the initial systematic review almost completed, and an Expert Group meeting planned for mid-January.</p>
<b>R.3</b>	Plan for coming 6 months (activities, output)	<p>Two further publications planned from the Rebound Project:</p> <p>Sorrell, S. 'The rebound effect definition and estimation', in L. Hunt (eds) <i>International Handbook of Energy Economics</i>, Edward Elgar, 2008</p> <p>Sorrell, S. and H. Herring (eds), <i>Energy Efficiency and sustainable consumption: dealing with the rebound effect</i>, Palgrave, 2008</p> <p>The Transport Project is scheduled for completion and launch in June 2008.</p> <p>The subjects of the next projects are currently under discussion with the TPA Advisory Group but likely to be on the topics of biomass uses and 'peak oil'.</p>
<b>July – Dec 2007</b>	<b>P. Publications</b>	
<b>P.1 Journal Articles</b>	Forthcoming publication in 'IET Generation, Transmission and Distribution', based on work done for the Intermittency Project (paper accepted for publication): Skea, J; Anderson, D; Green, T; Gross, R; Heptonstall, P; Leach, M <i>Intermittent renewable generation and the cost of maintaining power system reliability</i>	
<b>P.3 Reports/ Confere/ papers/presentations/working papers/meetings reports</b>	<ul style="list-style-type: none"> <li>▪ Sorrell, S. <a href="#">The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency</a>, UKERC Review of evidence for the rebound effect, UK Energy Research Centre, London, 2007</li> <li>▪ Sommerville, M. and S. Sorrell, <i>Technical Report 1: Evaluation studies</i>, UKERC Review of evidence for the rebound effect, UK Energy Research Centre, London, 2007</li> <li>▪ Sorrell, S. and J. Dimitropoulos, <a href="#">Technical Report 2: Econometric studies</a>, UKERC Review of evidence for the rebound effect, UK Energy Research Centre London, 2007</li> </ul>	

	<ul style="list-style-type: none"> <li>▪ Allan, G. M. Gilmartin, K. Turner, P. McGregor and K. Swales, <i>Technical Report 4: Computable General Equilibrium modelling studies</i>, UK Energy Research Centre London, 2007</li> <li>▪ Broadstock, D., L. Hunt and S. Sorrell, <a href="#">Technical Report 3: Elasticity of substitution studies</a>, UKERC Review of evidence for the rebound effect, UK Energy Research Centre London, 2007</li> <li>▪ with J. Dimitropoulos, <a href="#">Technical Report 5: Energy, productivity and economic growth studies</a>, UKERC Review of evidence for the rebound effect, UK Energy Research Centre London, 2007</li> </ul>
	<b>PL. Policy Links</b>
<b>PL.1 Response to consul, evidence given to Committees, etc</b>	Separate meetings held with BERR and Office of Climate Change (OCC) at their request, to explain findings from the Investment Decisions report.
	<b>C. Communications</b>
<b>C.4 Media coverage</b>	The report on the rebound effect received wide publicity in national and international media, including BBC World Service, BBC Radio 4 ('Today'), 3 national newspapers, five local radio stations, Economist magazine and others.

## Research Atlas

<b>July – Dec 2007</b>	<b>R. Research Programme Overview</b>	
<b>R.1</b>	Review of Milestones incl outputs	<p><b>Target :</b> <i>Continued development of the user interface to the Research Register – specific tasks include : a) display of total project value, industrial partner, recognised partner details if the input data can be obtained, b) downloadable summaries for input into Excel/Access.</i> <b>Reality :</b> <b>User interface has been developed – total project value, industrial partner and recognised researcher fields now all held and displayed</b></p> <p><b>Target :</b> <i>Continuing the import of data into the Register.</i> <b>Reality :</b> <b>Data from a wide range of new funding bodies (DfT, DEFRA, DCLG, ESRC, BBSRC, Highways Agency) has been located and entered into the database. As at 11 Dec 2007 – 428 of these new grants remain to be proofread and categorised.</b></p> <p><b>Target :</b> <i>Development of a specification to move the research landscape into www database format.</i> <b>Reality :</b> <b>Started – in initial stages</b></p> <p><b>Target :</b> <i>Consideration to creation of a Transport Policy database for the Demand Reduction Theme – progress depends on the speed at which a specification is agreed.</i> <b>Reality :</b> <b>Draft www pages created, now awaiting input from the IMPACT team</b></p>

		<p>Targets set in July : by 31/12/07 : a) the Register contains at least 1000 grants. <b>(Reality : 960 grants on 11/12/07, so target is likely to be met)</b> , b) PI's have been emailed and asked to check their grant entries and provide additional information <b>(Reality : deferred until NERC, ESRC and BBSRC data has been entered)</b> , c) all grants funded by EPSRC with a start date of 1 Jan 2004 have been inspected for inclusion in the Register <b>(Reality : not achieved due to decision to prioritise newer data from other funding bodies)</b> , d) Some NERC grants have been imported <b>(Reality : achieved – register contains 26 NERC grants – and raw data dump of several hundred possible energy relevant grants also obtained from NERC)</b> , 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) <b>(Reality : not achieved – in forward plan)</b></p> <ul style="list-style-type: none"> <li>▪ Expect to use 8.00-9.00 sm =&gt; cost expected to be in range 50k£-60k£ – variation may occur due to data availability from the funding sources.</li> </ul>
R.2	Progress against plan (brief narrative highlighting progress/changes from planned activity)	As above
R.3	Plan for coming 6 months (activities, output)	<ul style="list-style-type: none"> <li>▪ Continued development of the user interface to the Research Register – specific tasks include : downloadable summaries for input into excel/Access</li> <li>▪ Continuing the import of data into the Register</li> <li>▪ Development of a specification to move the research landscape into www database format</li> <li>▪ Consideration to creation of a Transport Policy database for the Demand Reduction Theme – progress depends on the speed at which a specification is agreed</li> <li>▪ The targets being that by 30/06/08 :</li> <li>▪ a) the Register contains at least 1300 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) 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)</li> </ul>
	<b>O. Research Opportunities</b>	
<b>O.1 Research Atlas: landscapes</b>	<ul style="list-style-type: none"> <li>▪ 1,056 page loads of data took place between 1 September and 30 November – on average there are 6 visitors per day to the Landscapes</li> </ul>	

<b>O.2 Research Atlas: roadmaps</b>	<ul style="list-style-type: none"> <li>▪ 749 page loads of data took place between 1 September and 30 November – on average there are 4 visitors per day to the Roadmaps</li> </ul>
<b>O.3 Research Register</b>	<ul style="list-style-type: none"> <li>▪ As at 11 December 2007, the Research Register contains 960 (a substantial increase from the 862 grants held in September) (additional data sources added include DfT, DEFRA, DCLG, ESRC, BBSRC, Highways Agency);</li> <li>▪ As at 11 December 2007 a total of 3,689 EPSRC grants have been inspected and deemed not to be energy-relevant – September number was 3209 and July number 2177 (thus all EPSRC grants with a start date of 1 January 2006 or later have now been inspected);</li> <li>▪ Since September the database software has been improved – fields to store the Total Project Value, Industrial Collaborators, and Recognised Researchers has been added – these data fields are now imported weekly from the EPSRC grants database; and the energy categorisation software has been re-written and consequent grant inputting &amp; processing time has been reduced significantly;</li> <li>▪ The first batch of NERC data was obtained in June and has been loaded manually, since then discussions have taken place with NERC with the result that a bulk transfer of data has taken place and will be imported into the Register in the next few months;</li> </ul> <p>5,052 page loads of data took place between 1 September and 30 November – on average there are 6 visitors per day to the Register. As at 30 November 2007 41,711 pages of information had been accessed by 4,604 different users of the Research Register (of these users, 1174 have visited the Register at least twice)</p>
<b>O.4 Energy Data Centre design/entry/hits</b>	<ul style="list-style-type: none"> <li>▪ 481 page loads of data took place between 1 September and 30 November – on average there are 3 visitors per day to the EDC</li> </ul>
	<b>E. Regional/National Industry Engagement</b>
<b>E.1 Regional/industrial participation in meetings</b>	<ul style="list-style-type: none"> <li>▪ 24 Oct 2007 – Presentation about UKERC Research Atlas and Register made to staff at the Technology Strategy Board</li> </ul>
	<b>C. Communication</b>
<b>C.1 Website</b>	Participation in STFC/UKERC meetings about the new UKERC www site
<b>C.4 Media Coverage</b>	Invitation to be interviewed by ITN on 10 December 2007 about wind power passed to Prof Jenkins as I was unable to reach a studio at the desired time.

# Energy Data Centre

<b>July – Dec 2007</b>	<b>R. Research Programme Overview</b>	
<b>R.1</b>	Review of Milestones incl outputs	<ul style="list-style-type: none"> <li>▪ Metadata category list completed and on-line at: <a href="http://ukedc.rl.ac.uk/EDC_meta.html">http://ukedc.rl.ac.uk/EDC_meta.html</a></li> <li>▪ Metadata now held in a single searchable database structure</li> <li>▪ EDC www site front end revised and all links updated (work ongoing to make Data Archive conform to the appearance of the front end)</li> <li>▪ Levelised Electricity Unit Cost Estimates (International) from UKERC's TPA report posted on EDC</li> <li>▪ UK MARKAL 2007 Electricity Generating Technologies data from UKERC Energy Systems &amp; Modelling Theme posted on EDC</li> <li>▪ Carbon Trust declined to co-operate over early release of household energy consumption data from the Micro CHP Accelerator project</li> <li>▪ Carbon Trust is sending Advanced Metering Field Trial data (expected imminently, but data will need some processing to make anonymous before posting)</li> <li>▪ In discussion with UCL about Energy in Buildings Data Centre under umbrella of EDC</li> </ul>
<b>R.2</b>	Progress against plan (brief narrative highlighting progress/changes from planned activity)	<p>Achievements for the latest six months period are noted above.</p> <p>The Scoping Study has been delayed due to the ongoing problem of persuading potential stakeholders to engage with the EDC, which creates difficulty in estimating the amount of effort required to operate the EDC in future. Even UKERC Themes have been slow to provide data. Without an obligation placed on projects by EPSRC (as specified by NERC and ESRC for their data centres) and perhaps also recognition of data posted as a citable publication, it will remain difficult to persuade stakeholders to commit the not inconsiderable time and effort required to tidy and document data sets. Also, data-holders either do not appreciate the value embodied in their derived data sets or they are unwilling to share them with their perceived competitors. It has taken a while to appreciate how these factors impinge on the effectiveness of the EDC. A suitable discussion of options will be discussed in the Scoping Study.</p> <p>Energy data from buildings has been identified as a specific area where there is a great need for high quality data and difficulty in accessing existing data. The EDC is in discussion with UCL about how to rectify this situation.</p>



<b>R.3</b>	Plan for coming 6 months (activities, output)	<ul style="list-style-type: none"> <li>▪ Complete work on EDC www site to make the Data Archive conform to the appearance of the front end</li> <li>▪ Formalise access to hourly temperature data from Met Office stations (via BADC at RAL), required by Demand Reduction Theme to process into degree-day data, then implement collection and processing algorithm, supplied by Demand Reduction</li> <li>▪ Post Carbon Trust Advanced Metering Field Trial data on EDC</li> <li>▪ Complete Scoping Study for the future EDC</li> </ul>
	<b>O. Research Opportunities</b>	
<b>O.4 Energy Data Centre design/entry/hits</b>	<ul style="list-style-type: none"> <li>▪ 665 page loads of data since 26 July 2007 (388 different visitors, of whom 78 returned) – an average of 3 visitors per day</li> </ul>	
	<b>E. Regional/National Industry Engagement</b>	
<b>E.3 National/industrial participation in meetings</b>	<ul style="list-style-type: none"> <li>▪ Attended ESDS International Annual Conference 2007 (presentation by Jean-Yves Garnier of IEA Energy Statistics Division)</li> </ul>	
<b>E.4 Links with national contact points</b>	<ul style="list-style-type: none"> <li>▪ In discussion with BADC over access to hourly temperature data for Met Office stations, required by Demand Reduction Theme to process into degree-day data</li> <li>▪ In discussion with Carbon Trust (Steve Wyatt) over access to Advanced Metering Field Trial data</li> </ul>	

## Appendix 2

### UKERC Energy 2050

Code	Indicator	Notes
<b>R Research Programme Overview (filled in every 6 months)</b>		
R.1	Review of Milestones incl outputs	<p>The following milestones have been achieved:</p> <ul style="list-style-type: none"> <li>a) the scenario set underpinning the project has been agreed</li> <li>b) detailed assumptions for core scenarios have been set</li> <li>c) methods for linking key modelling tools, linking sectoral with system models, has been agreed</li> <li>d) a set of outputs and publication schedule has been established</li> <li>e) a governance structure has been firmed up with four active Working Groups, each taking responsibility for one or more of the final outputs</li> <li>f) the work has been presented to the Office of Climate Change and parts of BERR Energy group</li> </ul>
R.2	Progress against plan (brief narrative highlighting progress/changes from planned activity)	<p>The project has now been successful in forcing constructive engagement between researchers from different disciplines and backgrounds. Two particular areas where hard debate, which has yielded results, has taken place have been in the areas of lifestyles/behaviour/consumer decision-making and defining energy security/system resilience. We would have hoped to have actually modelled our core scenarios by the end of 2007 but continuing model development and debate about key input assumptions puts us about 2 months behind schedule.</p>
R.3	Plan for coming 6 months (activities, outputs)	<ul style="list-style-type: none"> <li>▪ Core scenarios will be run using two, or perhaps three, system models by end February</li> <li>▪ A report describing different pathways and ambitions for a low carbon economy will be published in late April.</li> <li>▪ A report assessing the contribution of technological development, and associated innovation needs, will be prepared by late June</li> <li>▪ Work will continue to prepare detailed variant scenarios to explore lifestyles and</li> </ul>

Code	Indicator	Notes
		behaviour, security issues, environmental constraints, and global energy market developments. These will be modelled and published in the second half of 2008 and early 2009.
<b>PL Policy Links</b>		
PL.1	<b>Response to consultation, evidence given to Committees, etc</b>	Presentations on the project have made at OCC and BERR. External people from business, consultancies and NGOs have contributed to the project development through working group activity.
<b>C Communication</b>		
C.1	Website	A project flier has been produced and circulated to a wide range of stakeholders. An intranet site has been created to host all project-related documents.