

Research Councils UK Energy Programme Strategy Fellowship

Energy Strategy Fellowship Report 1:

Summary of Consultation Responses and Way Forward

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Research Councils Energy Programme

The Research Councils UK (RCUK) Energy Programme aims to position the UK to meet its energy and environmental targets and policy goals through world-class research and training. The Energy Programme is investing more than £625 million in research and skills to pioneer a low carbon future. This builds on an investment of £839 million over the period 2004-11.

Led by the Engineering and Physical Sciences Research Council (EPSRC), the Energy Programme brings together the work of EPSRC and that of the Biotechnology and Biological Sciences Research Council (BBSRC), the Economic and Social Research Council (ESRC), the Natural Environment Research Council (NERC), and the Science and Technology Facilities Council (STFC).

In 2010, the EPSRC organised a Review of Energy on behalf of Research Councils UK in conjunction with the learned societies. The aim of the review, which was carried out by a panel of international experts, was by o to provide an independent assessment of the quality and impact of the UK programme. The Review Panel concluded that interesting, leading edge and world class research was being conducted in almost all areas while suggesting mechanisms for strengthening impact in terms of economic benefit, industry development and quality of life.

Energy Strategy Fellowship

The RCUK Energy Strategy Fellowship was established by EPSRC on behalf of Research Councils UK in April 2012 in response to the international Review Panel's recommendation that a fully integrated "roadmap" for UK research targets should be completed and maintained. The position is held by Jim Skea, Professor of Sustainable Energy in the Centre for Environmental Policy at Imperial College London. The main initial task is to synthesise an *Energy Research Prospectus* to explore research, skills and training needs across the energy landscape. Professor Skea leads a small team at Imperial College London tasked with developing the *Prospectus*.

The *Prospectus* will contribute to the evidence base upon which the RCUK Energy Programme can plan forward activities alongside Government, RD&D funding bodies, the private sector and other stakeholders. The tool will highlight links along the innovation chain from basic science through to commercialisation. The tool will be flexible and adaptable and will take explicit account of uncertainties so that it can remain robust against emerging evidence about research achievements and policy priorities.

One of the main inputs to the *Prospectus* is a series of three high-level strategic workshops and six in-depth expert workshops taking place October 2012- July 2013. Following peer-review, the first version of the *Prospectus* will be published in Autumn 2013 and will then be reviewed and updated on an annual cycle during the life the Fellowship which ends in 2017.

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1. Introduction

1.1 About the Fellowship

The Research Councils UK (RCUK) Energy Programme Strategy Fellowship was established in April 2012 for a period of five years. The main goal of the Fellowship over the first 18 months is to produce a prospectus of energy research, skills and training needs.

The development of the prospectus follows a recommendation made by the International Panel for the RCUK Review of Energy in 2010.¹ The Panel noted that “across almost all areas reviewed by us we found interesting, leading edge and world class research. The excellent international reputation of UK research is deservedly earned”. However, the Panel also noted “fundamental weaknesses”. “The weaknesses arise because of a lack of a sustained long-term coherent energy research programme across the different funding bodies, competition between the funding bodies, a lack of transparency particularly as perceived by the researchers and poorly executed or non-existent mechanisms for moving technologies from the research stages to early demonstration, application and deployment.”

The Panel recommended the development of a fully integrated “roadmap” of UK research, skills and training needs be completed and maintained to allow all to know and understand what is considered essential to meet society’s needs. The consensus from this consultation is that the term “roadmap” does not accurately describe the product that would be of most use to the Research Councils, as a roadmap implies coverage of all the steps needed to achieve full commercial deployment of technologies. We failed to find an entirely satisfactory alternative term, but have adopted the term “prospectus” as being closest at capturing what we aim to produce.

The aim is to produce a first version of the prospectus by autumn 2013. Following that, the prospectus will be maintained and refreshed, and the Fellowship team will conduct its own programme of research into the effectiveness of energy innovation systems internationally.

The Research Councils appointed Jim Skea, Professor of Sustainable Energy at Imperial College London, as the RCUK Energy Programme Strategy in April 2012 and he stepped into the role full-time in July 2012. Other members of the team are Postdoctoral Research Fellow Dr Aidan Rhodes, and Postdoctoral Research Associate Matthew Hannon.

1.2 The Way Forward

Following the results of the consultation described in this report, the Fellowship team is planning to conduct two types of workshop. Three initial “strategic” workshops to be held before the end of 2012 will engage a wide range of stakeholders and address high-level cross-cutting issues. In the first half of 2013, the Fellowship team will hold six “expert” workshops exploring in more depth research, skills and training needs associated with specific parts of the energy domain.

¹ International Panel for the RCUK Review of Energy 2010, *Progressing UK Energy Research for a Coherent Structure with Impact*, Research Councils UK, Swindon, 2010, www.rcuk.ac.uk/documents/reviews/reviewpanelreport.pdf

The strategic workshops will take the form of single day events held in Central London. These will cover:

- *Policy and Societal Needs:* 24 October 2012
- *The Role of the Social and Environmental Sciences:* 13 November 2012
- *Research Councils and the Energy Funding Landscape:* w/c 3 December 2012.

The expert workshops will take the form of longer 2-day residential events engaging 30-35 experts, covering academic, industrial and government policymaking stakeholders. These will be held at locations around the UK. These will address the following topics, though not necessarily in this order:

- *Bioenergy*
- *Fossil Fuels and CCS*
- *Electrochemical Energy Technologies*
- *Energy Infrastructure*
- *Energy in the Home and Workplace*
- *Transport Energy*

These will be held in the weeks commencing: 7 January; 4 February; 4 March; 15 April; 13 May; and 10 June 2013. A final wrap-up strategic workshop will be held in July 2013.

Following the workshops, the Fellowship team will review the collected evidence, as well as background literature, scenarios and datasets. The Fellowship team will be treating nuclear fission, industrial energy demand and wind/wave/tide as 'light-touch' subjects, requiring a background literature search but no expert workshop, due to the wealth of good-quality roadmaps and analyses currently covering these sectors. The Fellowship team plan to publish the prospectus as a high-level overview document supported by a Web-based resource of sector-specific documents.

2. Conducting the consultation

This summary of responses was compiled from the written responses to the consultation document '**Options for developing a "roadmap" of energy research, skills and training needs**'², which was circulated around the academic energy research community during July and August 2012. The consultation focused on the process through which the research prospectus will be developed between autumn 2012 and summer 2013. Responses have also been included from a variety of stakeholder interviews the Fellowship team carried out over the April-September 2012 period. Interviews have been carried out with government policymakers, professional bodies, the Research Councils and other interested national and international organisations. A full list of respondents and interviewees can be found at the bottom of this document.

² 'Options for developing a "roadmap" of energy research, skills and training needs', RCUK Energy Strategy Fellowship, July 2012, <https://workspace.imperial.ac.uk/icept/Public/RCEP%20Energy%20roadmap%20consultation%2009-07-12.pdf>

This document covers all of the questions posed in the consultation document but follows a slightly different ordering in order to create a more flowing narrative.

3. Key Points from the Consultation

3.1 Choice of Name

Following early consultations, and having participated in training for the development of “technology roadmaps”, the Fellowship team reached the conclusion that the term “roadmap” was not consistent with the nature of the ultimate document, which would provide an evidence-based tool for the RCUK Energy Programme to help plan its forward activities. Thus, Question 1 on the consultation asked:

Q1) We do not think that the term “roadmap” accurately describes the outputs of this work. We are proposing instead to use the term “Energy research prospectus”. Do you agree with this change of terminology? Are there other terms you would like to propose?

This question elicited a variety of responses. There were several respondents who believed that the choice of name was not an important factor in the development of the tool - however there were many more that believed the name was an important marker of the aims and achievements of the tool and that the choice of name would influence who would read the final document. There was a general supportiveness to move away from the ‘roadmap’ term and general agreement that this did not accurately reflect the definition of the proposed tool. The term ‘prospectus’ was accepted by the majority of respondents - however there were many concerns raised that the name sounded neutral, unfocused and lacking urgency - not adequately conveying the scope and importance of the work. Any name chosen needs to emphasise that the tool is an independent piece of work, and not an official RCUK plan or strategy. Alternative names suggested included; ‘Appraisal’ ‘Energy Research Scenarios’, ‘Energy Research Objectives’ ‘Energy Desideratum’ and ‘Energy Research Outlook’.

3.2 Other High Level Points

Several respondents and interviewees provided high-level insights that do not fit directly into the scope of the other questions. A point that was made several times was that the roadmap should ensure that the scope and potential of UK energy research to create global export market opportunities is not overlooked in favour of an exclusive focus on UK energy policy goals. There may be opportunities in which a particular technology offers business opportunities globally over and above its contribution to UK policies. There was also a desire from several respondents to see the roadmap explore the entire UK innovation structure and the interactions with basic RCUK-funded research - it was thought that this was essential to analyse the requirements and effects of skills and training in the sector in the long term, as well as the effectiveness of the translation of basic research into applied product development. The interaction between UK- and EU- funded research programmes should also not be ignored.

Q2. Do you think the proposed way of presenting the outcomes of the work is appropriate? Do you have alternative suggestions?

The Fellowship's plan to present the results from the exercise via a high-level briefing document, with more detailed topic-specific documents available from the Fellowship website, was met with broad acceptance from respondents.

There are several areas of energy research that exist in EU and IEA classifications but that are 'missing' from the scope of the RCUK Energy Programme. These include principally work on hydro, geothermal research and concentrated solar power (CSP)/solar thermal research, but also other emerging areas. The consultation asked:

Q4. Should any of the areas "missing" from the RCUK Energy Programme be brought within the scope of the roadmapping activity?

Respondents generally thought that hydro was a well-understood and researched area, and there was no pressing need to cover it in detail. There were several responses arguing that solar thermal should be included, not because the technology would have great application in the UK, but because solar thermal technologies are attracting considerable global attention, and parts of the UK supply chain could stand to benefit from a strong export market.

Geothermal in the UK is considered a less mature technology, but is attracting attention with projects in Newcastle and the South West. This was the most popular technology to include as part of the Fellowship's activities, due to the need for considerable basic research, substantial European prospects for the technologies, and UK academics' skillbases in geothermal and related research. The potential of solar fuels, being the research into producing usable fuels directly via solar energy, was mentioned by a couple of respondees.

The Fellowship was set up to address "research, skills and training needs". During early consultations, it has been suggested that the need for and allocation of research *facilities* - such as those operated by the Science and Technology Funding Council at its Harwell site - should fall within the scope of the work. "Facilities" should also include other assets such as energy data sets, modelling tools and other software assets.. The consultation asked:

Q6. Would it be desirable to bring research facilities within the scope of the roadmapping work? What range of facilities should be considered?

The vast majority of respondents were very supportive of this point, and indeed suggested other facilities such as the National Grid laboratories in Manchester and the European Marine Energy Centre in Orkney. The Fellowship will therefore explore the importance and utilisation of research facilities when considering skills and training needs.

Other respondents noted that the curation of and access to data was another underpinning need in many areas of energy research. Data needs will also be assessed in the development of the prospectus.

The name of the 'technical workshops' referred to in the consultation have been changed to 'expert workshops' to more fully reflect the range of skills and expertise that will be required at these meetings (i.e. not just physical science and engineering).

4. Shaping the Activity – Strategic Workshops

It is envisaged that two types of workshops will be held: a) broad “strategic” workshops which will deal with energy research and training in the context of wider policy, societal and commercial needs; and b) technical, topic-based workshops which will offer a space for experts in the relevant field to focus on detailed research, skills and training needs. Question 3 in the consultation asked:

Q3. Do you agree that it would be preferable to start with the strategic workshops? What are the reasons for your view?

Most respondents concurred with the Fellowship team’s view that it was preferable to begin the exercise with the three strategic workshops, as this would help to set the context for the exercise and influence the questions that should be asked and data collected from the expert workshops. Some stakeholders suggested holding a ‘follow-up’ strategic workshop after the expert workshops were completed, in order to contextualise the findings from the expert workshops in the greater energy system. The Fellowship team is therefore minded to follow this strategy.

The Fellowship team advanced two options for structuring the strategic workshops. The first was *theme-based* and pragmatically addressed: a) how energy research funded by the Research Councils may interface with policy and societal needs; b) links to other bodies in the energy research funding landscape; and c) the role of the social and environmental sciences vis-à-vis engineering perspectives which define the current RCEP structure. The second *technology-based* structuring was informed by evidence from the social sciences about how people engage with different types of technology, with three workshops covering a) energy end use, microgeneration and smart grids, b) renewables and networks and c) fossil fuels, nuclear, hydrogen and biomass. Questions 7 and 8 asked:

Q7. Which option for structuring the strategy workshops would you prefer? What are the reasons for your preference?

Q8. If you are not attracted by either option for structuring the strategy workshops, what alternative approach would you recommend?

The vast majority of respondents preferred the first (theme-based) option for the strategy workshops, feeling it represented the interdisciplinary nature of the energy sector more thoroughly and inclusively, helping setting up the clustering of technologies in the expert workshops more successfully. In addition, it was hoped that a theme-based structure for the strategy workshops would contextualise discussions on skills and training needs more successfully.

No respondents thought that the technology-based workshop structure was more attractive. However, the two approaches could be considered as forming a matrix and aspects of the technology-based approach could be used to help structure individual theme-based workshops. Most respondents advanced no alternative to the two proposed workshop structures - the only two received proposed structuring the workshop via a transitions pathways model, where the three workshops looked at what needed to be accomplished at various stages to 2050.

5. Mapping The Landscape – Expert Workshops

It was proposed that the major part of the evidence gathering phase would involve six to eight in-depth expert workshops on specific areas of the RCUK Energy Programme, designed to explore uncertainties and outcomes surrounding a specific energy sector. The Fellowship presented three options for structuring these workshops - *skills-based*, where similar skill sets were grouped together, *technology system-based*, where similar technologies were grouped, and *maximum aggregation*, where complementary technologies and skillsets are grouped together in such a way as to reduce the total workshops required.

Q11. Broadly, do you have a preference for any one of the options for clustering the technical workshops over another? Would you advocate a completely different approach and if so why?

The options are summarised in Table 1.

There was a general preference for the *maximum aggregation* option from the respondents and interviewees. It was felt that this option would lead to greater cross-fertilisation of ideas between disciplines, lead to more informed discussions of transferable skills and resources, and help to prevent the ‘unrealistic optimism’ which sometimes occurs with discussions involving single disciplines in isolation. The *skills-based* approach was second-favourite among respondents, as once again it allows discussion outside the usual technology-based ‘silos’ that often characterise energy research. Several remarks were made that economics and the social science disciplines do not fit easily into a single workshop, and these disciplines need to be reflected across all workshops and technology areas.

In several areas of technology, there already exists a wealth of high-quality evidence and road-mapping exercises. Due to limited budgets, it is not possible to cover all topic areas in detail. The Fellowship, before the consultation, identified two candidate areas for light-touch, desk-based reviews. There are *nuclear fission* where there has been a great deal of recent activity in relation to training and skills needs, though there may remain gaps in terms of research needs; and *industrial energy demand* where the community of interested parties is small and a structured activity would require a disproportionate use of resources.

Q9. Do you agree that nuclear fission and industrial energy demand are candidates for a “light-touch review” process? Are there other topics that could be dealt with in this way?

Due to the nuclear fission R&D review currently being carried out by Professor Sir John Beddington as well as the wealth of existing work in this area, the majority of respondents agreed that a full workshop-based exercise would not be necessary for the Fellowship to conduct in this sector. Reactions to the proposal to treat industrial energy demand as a light-touch sector were more mixed. While most stakeholders agreed the community in the UK was very small, the potential importance to the UK economy and energy policy in the future was considered by many to be high. A great deal of this work is conducted in the industrial sector, away from academic research. Our provisional decision is to address this topic in a small, focused workshop with a relatively small number of participants.

Table 1: RCEP Energy Research Areas: Overview of Clustering Options for Technical Roadmapping Workshops

Energy Programme Area	Option 1: Skills-based	Option 2: Technology system-based	Option 3: Maximum aggregation
Bioenergy	<ul style="list-style-type: none"> Bioenergy 	<ul style="list-style-type: none"> Bioenergy 	<ul style="list-style-type: none"> Bioenergy
Carbon Capture and Storage	<ul style="list-style-type: none"> Carbon capture, transport and combustion Fossil fuel production and carbon storage 	<ul style="list-style-type: none"> CCS and combustion 	<ul style="list-style-type: none"> Fossil fuel and CCS
Conventional combustion/oil and gas strategy	<ul style="list-style-type: none"> Carbon capture, transport and combustion Fossil fuel production and carbon storage 	<ul style="list-style-type: none"> CCS and combustion Fossil fuel production 	<ul style="list-style-type: none"> Fossil fuel and CCS
End use energy demand	<ul style="list-style-type: none"> Built environment energy demand Transport energy demand Industry energy demand (light touch) 	<ul style="list-style-type: none"> Built environment and transport Industry energy demand (light touch) 	<ul style="list-style-type: none"> End use energy demand
Energy storage	<ul style="list-style-type: none"> Electro-chemical energy technologies 	<ul style="list-style-type: none"> Fuel cells and storage 	<ul style="list-style-type: none"> Electro-chemical energy technologies
Fuel cells	<ul style="list-style-type: none"> Electro-chemical energy technologies 	<ul style="list-style-type: none"> Fuel cells and storage 	<ul style="list-style-type: none"> Electro-chemical energy technologies
Marine	<ul style="list-style-type: none"> Wind, wave and tide 	<ul style="list-style-type: none"> Wind, wave and tide 	<ul style="list-style-type: none"> Wind, wave and tide
Nuclear fission	<ul style="list-style-type: none"> (Light touch review) 	<ul style="list-style-type: none"> (Light touch review) 	<ul style="list-style-type: none"> (Light touch review)
Solar	<ul style="list-style-type: none"> Electro-chemical energy technologies 	<ul style="list-style-type: none"> Solar 	<ul style="list-style-type: none"> Electro-chemical energy technologies
Sustainable energy networks	<ul style="list-style-type: none"> Energy infrastructure 	<ul style="list-style-type: none"> Energy infrastructure 	<ul style="list-style-type: none"> Energy infrastructure
Sustainable energy vectors	<ul style="list-style-type: none"> Electro-chemical energy technologies Energy infrastructure 	<ul style="list-style-type: none"> Energy infrastructure 	<ul style="list-style-type: none"> Electro-chemical energy technologies Energy infrastructure
Transport operations	<ul style="list-style-type: none"> Transport energy demand 	<ul style="list-style-type: none"> Built environment and transport 	<ul style="list-style-type: none"> End use energy demand
Whole systems	<ul style="list-style-type: none"> Strategy level 	<ul style="list-style-type: none"> Strategy level 	<ul style="list-style-type: none"> Strategy level
Wind	<ul style="list-style-type: none"> Wind, wave and tide 	<ul style="list-style-type: none"> Wind, wave and tide 	<ul style="list-style-type: none"> Wind, wave and tide

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It was also pointed out that offshore wind, marine technologies and CCS have been covered in detail by previous mapping exercises, and that these areas could also be completed in a light-touch review. We have therefore dropped the idea of an expert workshop on wind/wave and tide. CCS will be covered in a wider workshop covering fossil fuels. We also received comments that the demand side needed better coverage. We will therefore run two demand side expert workshops, on *Transport Energy* and *Energy in the Home and Workplace*. The letter will cover energy use on residential and non-residential buildings plus the adoption of generic industrial energy technologies. This will not cover process industries such as steel or chemicals.

The workshops will be structured to ensure that skills and knowledge connections can be made between separate but complementary energy sectors, such as transferable skills between the electrochemical knowledge and skills which could be transferred between solar PV and fuel cells.

Annex: List of Consultation Respondents

Written responses

Name	Organisation
David Howard	Centre for Ecology and Hydrology
Richard Green	Imperial College Business School
Ian Falconer	Independent Consultant
Jenny Cooper	National Grid
Geoff Dutton	Rutherford Appleton Laboratory
Robert Lowe	University College London
Bill Nuttall	University of Cambridge
Julian Allwood	University of Cambridge
Karen Parkhill	University of Cardiff
Catherine Butler	University of Cardiff
Jon Gibbins	University of Edinburgh
Peter Taylor	University of Leeds
Dermot Roddy	University of Newcastle
Nicola Pearsall	University of Northumbria
Gavin Killip	University of Oxford

Interviewees

Name	Organisation
Duncan Eggar	BBSRC
Vicky Jackson	BBSRC
James Wilde	Carbon Trust
Ashley Holt	Defra
Liz Owen	Energy Efficiency Deployment Office, DECC
Gareth Parkes	Energy Institute
Jonathan Radcliffe	Energy Research Partnership
Andrew Haslett	Energy Technologies Institute
Jason Green	EPSRC
Jacqui Williams	EPSRC
Paul Rouse	ESRC
Helen Farr	IET
Andy Furlong	Institute of Chemical Engineering
Tim Fox	Institute of Mechanical Engineering
Peter Main	Institute of Physics
Andrew Crudgington	Institution of Civil Engineers
Cecelia Tam	International Energy Agency
Chris Franklin	NERC
Dora Guzeleva	Ofgem
Jim Iley	Royal Society of Chemistry
Deirdre Black	Royal Society of Chemistry
Jim Halliday	Rutherford Appleton Laboratory
James Davey	Science and Innovation, DECC
Paul Durrant	Science and Innovation, DECC
Nafees Meah	Science and Innovation, DECC
Ed Daniels	Shell
Adam Cooper	Social Engagement, DECC
Laura Bellingham	Society of Biology
Catherine Ewart	STFC



Kevin Smith	STFC
Derek Allen	TSB
David Infield	University of Strathclyde
Harriet Kung	USDoE Office of Basic Energy Science
Corey Cohn	USDoE Office of Basic Energy Science