



UK Energy Research Centre

Technology and Policy Assessment
Stakeholder Workshop

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Contents

1. Introduction.....	3
2. Workshop agenda and format	3
3. Summary list of topics and selection criteria	4
4. Preferred topics identified by the breakout groups	5
5. Comments and observations made during plenary sessions	9
6. Emerging favourites, summary and next steps	10
Annex 1 – Accompanying notes to the ‘long list’ of topics.....	12
Annex 2 – Workshop attendees	16

1. Introduction

The Technology and Policy Assessment (TPA) function of the UK Energy Research Centre (UKERC) was established in 2004 to meet demand from policymakers, industry and other stakeholders for independent, policy-relevant assessments that address key issues and controversies in the energy field. The TPA team draws on existing energy research to develop accessible, credible and authoritative reports relevant to policymakers, other stakeholders and wider public debate. TPA assessments follow a clear and transparent protocol. These set out the approach to the question, the nature of the evidence base, the criteria for evidence selection and the process of analysis, assessment and synthesis.

An important part of the TPA methodology is to consult with stakeholders to identify which key issues in the energy field would be appropriate for the TPA team to address. The consultation process involves a combination of a stakeholder workshop, and follow-up bilateral discussions where appropriate. This note provides a summary of the stakeholder workshop held at Imperial College on 1st October 2009.

2. Workshop agenda and format

- Welcome and introduction from Jim Skea, UKERC.
- Keynote speech: ‘Research challenges – a CCC perspective’ from Adrian Gault, Chief Economist, Committee on Climate Change.
- TPA phase 1 (2004 -2009) overview and explanation of the TPA approach from Rob Gross & Steve Sorrell, UKERC.
- Phase 2 potential topics overview of the ‘long list’ (see section 3 and Annex 1), and explanation of the TPA topic selection criteria from Rob Gross, UKERC.
- Attendees were divided into three break-out groups to discuss topics on the ‘long list’ (and any new/revised topics suggested within each group), and to identify a ‘short list’ – the aim was for each group to come up with their top five or six topics.
- Each group then reported back on their ‘short list’, followed by discussion in plenary.
- The workshop was brought to a close with concluding remarks from Rob Gross, UKERC.

Note that the slides from all the workshop presentations, and this note, will be available from the UKERC TPA web pages at: <http://www.ukerc.ac.uk/support/tiki-index.php?page=TPA%20Overview>

3. Summary list of topics and selection criteria

The list of research topics below emerged from initial discussions with the TPA Advisory Group and from within the UKERC team, and formed the starting point for discussions with the workshop attendees, who were encouraged to propose new topics and/or to revise existing topics as they felt appropriate. The list was not intended to be exhaustive and, other than the broad category grouping, is presented in no particular order. Prior to the workshop, the TPA team drafted short accompanying notes for each topic, and these can be found in Annex 1.

Initial 'long list' of topics

Energy demand and demand side related policies
1. Barriers to energy efficiency – the role of split incentives (e.g. tenant/landlord) in reducing the take-up of cost-effective technologies
2. The potential for decoupling energy demand/CO ₂ emissions and economic activity
3. Policy effectiveness – energy efficiency programmes by energy suppliers
4. Assessment of the potential for increasing energy efficiency in the industrial sector

Policy design and tools for policy analysis
5. How useful are learning curves and other approaches to future cost projection?
6. Can market-based regulation deliver long term changes?
7. What is the evidence that UK heat market could be radically transformed?

Power generation, transmission and supply
8. Renewable energy resource assessments and the potential contribution of CCS and nuclear power to an all electric energy economy.
9. Are the UK's renewables targets feasible and if so how could they be achieved?
10. What are the options for filling the UK's potential electricity generation 'gap' from 2015 onwards?
11. Electricity storage: what are the economics and prospects of storage under conditions of high nuclear and renewables penetration?
12. What are the realistic prospects for a European Supergrid and low-carbon electricity from the Sahara?
13. The 'energy return on investment' (EROI) from different energy supply options
14. Investigation into the issues surrounding energy requirements for processing lower grade

uranium ores, and the size of remaining deposits relative to current and projected consumption

15. Bio-energy resource usage; trade-offs in the use of biomass; what role is there for biomass in the UK?

Energy security and energy in the wider economy

- 16. Energy Security, energy systems resilience
- 17. Adaptation of energy industries to climate change
- 18. The potential for ambitious low carbon policy and regulation to create employment and commercial activity

When evaluating these topics, workshop attendees were asked to take into account the TPA’s objectives and approach, and in particular the following criteria which are applied to all prospective TPA project topics:

- Does the question reflect the concerns of users?
- Is the question relevant to current energy policy debate and/or the objectives of UK energy policy?
- Are there important areas of conflict or confusion that a TPA assessment could help overcome?
- Can the question be made sufficiently concise as to allow it to be addressed within the timeframe and resource limits of the TPA?
- Is the question amenable to a synthesis assessment based on existing evidence? For example, is the question sufficiently tightly defined? Is an adequate evidence base both available and accessible?

4. Preferred topics identified by the breakout groups

Group 1 Facilitated by Rob Gross/Philip Greenacre)

‘Top five’ topics (and accompanying comments) identified by group 1

- **Bio-energy resource usage; trade-offs in the use of biomass; what role is there for biomass in the UK? (topic 15).**
 - A variety of issues need to be dealt with including: most efficient use of a limited resource?, where to direct it?, subsidy distortion, costs/abatement costs, supply chains, environmental issues, land availability, food security, is there enough sustainable biomass?, what’s the potential for more?
 - An important subject for DECC routemaps.

- Multiple pathways into multiple sectors.
- Opinions vary widely making it a good TPA topic in that respect.
- Need to look at the UK situation in a global context.
- Algae is a separate issue – leave it out.
- This subject benefits from having been ‘in the TPA topic list frame’ for a long time.
- Time criticality? note June 2010 Energy Directive.
- Could divide into two aspects: the situation out to 2020 and then beyond.
- **Can market-based regulation deliver long term changes? (topic 6)**
 - Question could be ‘under what conditions are major infrastructure projects taken forward and funded?’ Aim to understand infrastructure regulation/investment decisions.
 - Infrastructure delivery – role of markets, regulations, planning, international experience.
 - Focus on infrastructure like wires, cables, pipelines, storage facilities.
 - Note Dieter Helm’s paper: ‘Financing Infrastructure’ and Walt Patterson comment that ‘everything is infrastructure’.
 - Evidence base? There are various UK reports on infrastructure costs; info from Ofgem; international costs comparisons.
 - Could compare with non-energy infrastructure e.g. water or with how other countries plan their infrastructure development.
- **CHP/Heat pumps/district heating (partially covered by topic 4)**
 - CHP vs. heat pumps or is a combination best?
- **Electric vehicles vs. fuel cells vs. biofuels - ? death of hydrogen dream? (new topic)**
 - Transport pathways beyond 2025 - economics and cost-effectiveness.
 - Electrification vs. biofuels vs. fuel cells
 - Hydrogen pathway – dead or not? Future prospects? (but suggestion that there might not be that much evidence except IEA Technology Perspectives).
 - Possibly a topic better suited to the UKERC Flexible Research Fund.
 - More evidence exists on fuel cells so perhaps narrow down the scope.
- **Energy security including electricity storage & gas supply constraints (partly based on topics 11 and 16)**
 - Security on all timescales from split second to years.
 - Can we survive a long-term gas interruption?
 - Is there enough gas? Includes ‘Peak gas’ and LNG supply constraints.
- **Renewable energy resource assessment (topic 8)**
 - Felt to be back on the agenda now.
- **Behavioural change in the non-transport sectors (new topic)**
 - Behavioural change in the stationary, built environment sector.
 - What is the appetite for social change re energy use/carbon emission? What is socially acceptable?
- **Green growth/jobs (topic 18)**
 - Economic impacts of stimulus for low carbon economy.
 - More evidence/literature exists now.

Additional topic suggestions and comments from group 1

- ‘Peak everything’ – a material resources question – availability of lithium, rare earth metals etc.
- Potential contribution to energy efficiency/CO₂ savings of a range of commercial or near-commercial residential/industrial technologies e.g. ground & air-source heat pumps, LED lighting, micro-CHP & district heating.
- Portfolio mix vs. single pathway topic – which technologies are appropriate where?, what niche for what technology?, include exploration of ways in which technology synergies add even more value.
- Reassess completed TPA topics e.g. Intermittency revisited in light of more ambitious renewables targets.
- Topic 5 (learning curves) could include some transport issues e.g. electrification etc.
- Need to distinguish suitability of topics in terms of whether they are better suited for primary or secondary research.

Group 2 (Facilitated by Steve Sorrell/Jamie Speirs)

‘Top five’ topics (and accompanying comments) identified by group 2

- **Bio-energy resource usage; trade-offs in the use of biomass; what role is there for biomass in the UK? (topic 15).**
 - Considered to be a timely topic.
 - Need to respond to this quickly given DECC’s current priorities.
 - The issues surrounding international feed-stock trade was seen as important.
 - The issues of food security were also discussed.
- **The ‘energy return on energy investment’ (EROI) from different energy supply options (topic 13).**
- **How useful are learning curves and other approaches to future cost projection? (topic 5).**
 - The issue of the potential inadequacy of learning curves and the occurrence of some kind of ‘harmonic’ effects were discussed.
 - It was suggested that the focus on methodological issues would be interesting.
- **Policy effectiveness – energy efficiency programmes by energy suppliers (topic 3).**
 - Was considered to be interesting and tractable.
 - Possible linkages with the new ‘policy mixes’ topic (see below).
- **Evidence for the effectiveness of policy mixes, as opposed to stand-alone policies (new topic).**
 - Is there a way of testing policies for consistency and synergy?
 - Not clear how to form a question which lends itself to TPA type analysis. The evidence base was unclear and the scope at which this would become tractable is debatable.
- **Electricity storage: what are the economics and prospects of storage under conditions of high nuclear and renewables penetration? (topic 11).**

Additional topic suggestions and comments from group 2

- RD&D Metrics: What models have been successful in measuring RD&D funding efficacy? Can we inform RD&D funding priorities by suggesting how to measure it and then highlighting successful examples?
- Wave and Tidal: What has previous experience of technology support policy taught us about the way forward for wave and tidal?
- What are the impacts of climate change policy on energy prices, both in the UK and in other jurisdictions
- Is a split between heat, transport and electricity and the differentiation between supply and demand obstructing better policy design?
- Topic 1 (barriers to energy efficiency) was not considered sufficiently new and original.
- Topic 2 (decoupling energy and economic activity) was considered on the basis that it could be narrowed, but eventually decided that this was a low priority.
- Topic 6 (can markets deliver long-term change) was deemed unmanageable in scope.
- Topic 7 (transforming the UK heat market) was of interest to some and an evidence base in Denmark and Sweden was discussed, but had insufficient support within the group to be on the group's short list.
- Topic 8 (renewables resource assessment) was discussed as interesting and achievable but other topics were considered to be higher priority.
- Topics 9 (feasibility of UK renewables targets) and 10 (UK electricity generation gap) were considered too big and too prospective for an evidence-based review.
- Topic 12 (European supergrid and north-African solar power) was disregarded on a 'lack of evidence' basis.
- Topic 14 (size and quality of uranium deposits) was considered to be non-contentious and therefore not of interest to the TPA.
- Topics 16 (energy security and resilience) and 17 (adaptation of energy industries to climate change) were considered to be low priorities.
- Topic 18 (green jobs) was considered very interesting by the group but did not make their short list as some were not convinced by the green jobs arguments and highlighted the displacement of jobs rather than creation.

Group 3 (Facilitated by Phil Heptonstall)

'Top five' topics (and accompanying comments) identified by group 3

- **Electricity storage: what are the economics and prospects of storage under conditions of high nuclear and renewables penetration? (topic 11)**
 - Better phrased as 'What are the risks (and value) of the options for increasing flexibility on power systems?'
 - This should include electricity storage, but also other technologies that are able to provide enhanced flexibility such as interconnectors and smart grids, and assess the technical feasibility and performance of these options, including the value of that flexibility to the system and to potential investors.
 - See the Supergen FlexNet research programme for evidence?
 - Need to avoid overlap with the Electric Futures Lab work.

- **Can market-based regulation deliver long term changes? (topic 6)**
 - Can markets deliver? It was noted that some work has been started on this at Exeter University.
- **What is the evidence that UK heat market could be radically transformed? (topic 7)**
- **Renewable energy resource assessments and the potential contribution of CCS and nuclear power to an all electric energy economy (topic 8)**
 - Should focus on renewables.
- **Bio-energy resource usage; trade-offs in the use of biomass; what role is there for biomass in the UK (topic 15)**
 - Suggestion that the topic should include waste and heat.
- **Assessing the effectiveness of carbon trading schemes (new topic)**

Additional topic suggestions and comments from group 3

- Assessing the adequacies of international technology development to meet the current energy challenges.
- Impact of electric vehicles on electricity systems.
- Renewables in a system context.
- It was suggested that topic 18 (green jobs), if progressed, should draw on international studies.
- It was suggested that an assessment of the effectiveness of RD&D in driving down costs should be added to topic 5 (learning curves), if it was decided to proceed with this topic.

5. Comments and observations made during plenary sessions

Additional key comments and observations

From the morning sessions:

- The tension between time/manpower necessary for rigour and depth in a TPA project versus producing timely outputs was discussed. Must recognise that policy makers are attracted to reports addressing broad policy questions.
- There is a need to be pragmatic about a report's potential audience.
- One problem is that being too detailed, systematic etc. runs risk of producing an output which is too late and behind the policy curve.
- A full-length TPA project is around 12 months whereas a 'rapid' report would be 3-4 months (but this is as yet untested). Some felt that if it isn't broken, don't fix it – and the TPA approach isn't broken. There are already plenty of consultancies who produce less exhaustive, 3-4 month duration reports.
- Others framed this as 'What's the minimum we could do whilst still retaining the key aspects of the TPA approach?' i.e. – systematic review and TPA rigour.
- One suggestion was that the TPA should focus on specific aspects of broader questions.
- The importance of international comparisons in policy learning was emphasised.
- How useful has the TPA approach been in closing down rumbling debates?

Post breakout discussion:

- Although DECC are dealing with the security of supply issue, it was suggested that the 'short

list' looks unbalanced and incomplete without an energy security topic (this topic was included in only one group's 'top five'). Other comments relating to this topic were: what are the metrics of energy security? is it right for a TPA project?, it should include the concept of the 'topography of Security of Supply' – the risks during transition to a low carbon economy and the need to break down the topic into its constituent parts.

- Bio-energy, do we tackle this at the global context level? Resource is global but how we use it should be a UK-focussed issue. Possibility for linking with behaviour in the non-transport sector (new topic suggested by group 1).
- Is a global resources assessment feasible?
- An interconnection/smart/Supergrid topic should be on the short list.
- There is no topic on cost evaluation (and there should be).
- There was some support for the green growth/jobs topic and it ties up well with Carbon Trust/DECC project (and may help provide insight on where investment in promoting green jobs should be directed).
- Some attendees were keener on full-length TPA projects so if there are shorter projects attempted, the team should be careful to maintain a balance.

6. Emerging favourites, summary and next steps

Emerging 'favourites'

- All three groups placed the bio-energy topic in their 'top five'.
- The infrastructure delivery, heat markets and renewables resource assessment topics were placed in the 'top five' by two groups, although not necessarily the same two groups for each topic.

Summary and next steps

- Overall the meeting showed an appreciation of what the TPA is trying to do, recognising that there can be tensions between our approach and the topics we cover.
- The meeting provided a number of topics to add to our existing long list.
- Nevertheless, some topics are urgent and there was a sense that the TPA could usefully engage with urgent topics, perhaps through shorter reports.
- There was widespread support for a report which explores issues related the resources for, and utilisation of, bio-energy (including heat markets).
- Other priority issues identified by many at the meeting include: infrastructure delivery/investment; issues related to demand reduction and behaviour; a new look at renewable resources, perhaps linked to analysis of the need for new infrastructure/interconnection; attention to a systematic framework for security of supply in the context of moves to low carbon energy; a review of the evidence and methods for assessing the impact of clean energy policy on jobs and

growth and a generic evaluation of costs (current TPA attention to offshore wind could provide a case study).

- The next steps in the TPA process were also outlined, in particular some follow-up interviews with key stakeholders in order to decide upon a shortlist to be presented to the TPA Advisory Group early next year.
- In the meantime, the TPA team are already progressing a project on cost escalations in offshore wind.

Annex 1 – Accompanying notes to the ‘long list’ of topics

Energy demand and demand side related policies

- 1. Barriers to energy efficiency – the role of split incentives (e.g. tenant/landlord) in reducing the take-up of cost-effective technologies**
 - Could focus on the domestic sector, commercial sector or both.
 - Examine whether there is any evidence to support the long-established claims regarding the importance of split incentives.

- 2. The potential for decoupling energy demand/CO₂ emissions and economic activity**
 - Follow-on from the rebound project.
 - It is commonly assumed that technical and structural change has decoupled energy demand and carbon emissions from GDP in the OECD economies. A contrary view is that conventional measures of energy inputs and carbon accounting overstate the amount of decoupling and incorrectly attribute the sources of decoupling.
 - Could summarise and evaluate the evidence for decoupling, together with the contribution of different factors to decoupling.

- 3. Policy effectiveness – energy efficiency programmes by energy suppliers**
 - A broad area, but possible questions include:
 - Assessment of the energy savings achieved to date by these programs in the UK;
 - The associated costs and benefits of the programs;
 - Comparison of the relative effectiveness of different delivery mechanisms;
 - The effect of governance structures on delivery;
 - The potential for these measures to achieve further efficiency improvements in households.

- 4. Assessment of the potential for increasing energy efficiency in the industrial sector**
 - This could examine the potential to reduce energy consumption through technology development and process improvement, including process integration, and what options exist for future step changes in industrial energy efficiency.
 - Would need to identify which sectors to focus on, and whether to limit to existing technologies or to include proposed, but unproven developments.

Policy design and tools for policy analysis

- 5. How useful are learning curves and other approaches to future cost projection?**
 - This could review the evidence for cost reductions in a range of energy supply technologies and compare actual cost reductions with those forecast .
 - A TPA project along these lines has already begun, focusing upon offshore wind in the UK.

- 6. Can market-based regulation deliver long term changes?**
 - A range of topics have been identified related to the delivery of major changes to the

energy system and the impact of regulation, including:

- How and to what extent have major energy infrastructure projects been realised under liberalised markets?
- How does this compare with other market arrangements and what explains these differences?
- Is the UK particularly ‘bad’ at energy infrastructure investment and if so why?

7. What is the evidence that UK heat market could be radically transformed?

- The objective would be to examine the evidence of whether the heat market can be restructured sufficiently in the medium to long term to allow it to make a full contribution to the achievement of carbon reduction targets.
- Could include a policy analysis of the Renewable Heat & Energy Efficiency Strategy including the choice of a Renewable Heat Incentive or Obligation, and the roles of capital grants and regulation.

Power generation, transmission and supply

8. Renewable energy resource assessments and the potential contribution of CCS and nuclear power to an all electric energy economy.

- Numerous resource assessments exist, going back to the 1990s ETSU work. However the consensus that resource is not a limiting factor has been challenged in recent work (David Mackay). The relative limitations of CCS stores, renewable resources and nuclear sites could be re-examined in the light of the 80% carbon and 20% renewables targets
- A large potential literature exists and there is scope for methodological clarification

9. Are the UK’s renewables targets feasible and if so how could they be achieved?

- Topics linked to the redesign of the RO, recent measures to tackle planning and grid connection problems and micro-generation Feed in Tariff.
- Important to determine timing such that effectiveness of current policies can be assessed reliably.

10. What are the options for filling the UK’s potential electricity generation ‘gap’ from 2015 onwards?

- Could cover demand side response, nuclear life extensions, LCPD derogation, gas peaking plants etc.
- Potential to use analogous historical and/or international evidence to assess how such ‘gaps’ have been addressed in the past and/or in other countries.
- Need to distinguish a TPA style review from previous/prospective scenario/modelling exercises.

11. Electricity storage: what are the economics and prospects of storage under conditions of high nuclear and renewables penetration?

- Could examine the evidence on costs and technological suitability for the UK electricity system.
- Also look at how storage might be rewarded in a liberalised market.
- Potential to include heat storage?

12. What are the realistic prospects for a European Supergrid and low-carbon electricity from the Sahara?

- Might such a grid be able to play a significant role in de-carbonising European electricity in the medium to long term?
- Could be focussed on what such a grid would look like, how it would be funded.
- Need to distinguish TPA style review from a UKERC supply theme assessment.

13. The ‘energy return on investment’ (EROI) from different energy supply options

- The production and delivery of energy commodities is associated with energy consumption - for example, in exploration, extraction, transportation and processing. EROI measures the net energy gain once this consumption has been taken into account.
- The EROI varies widely between different supply sources and is methodologically challenging to estimate but the reported and anticipated decline in the global average EROI could have important implications.
- This study could summarise and evaluate the EROI estimates for a range of supply options and identify any trends.

14. Investigation into the issues surrounding energy requirements for processing lower grade uranium ores, and the size of remaining deposits relative to current and projected consumption

- Whilst the energy requirements part of this question could be included in the previous topics (see above), this goes somewhat further, to include the assessment if the evidence of resource constraint.
- Some parallels with the current TPA Global Oil Depletion project.

15. Bio-energy resource usage; trade-offs in the use of biomass; what role is there for biomass in the UK?

- UK-sourced bio-energy resources are relatively scarce and there is ongoing debate of what the most appropriate uses may be – e.g. should policy encourage only the most efficient use of biomass, or should it also consider the range of viable options available for each sector.
- E.g. biomass in sectors where alternatives are limited, instead of where they can deliver least cost per tonne of carbon saved.

Energy security and energy in the wider economy

16. Energy Security, energy systems resilience

- What is the evidence that the UK’s carbon reduction targets are consistent with a resilient, secure energy system?

17. Adaptation of energy industries to climate change

- Could include an assessment of how energy industries have responded to major external challenges in the past, and whether such challenges are analogous in any way to climate change.

- The aim is to understand the vulnerabilities and range of possible responses of different generation options, impacts on oil and gas extraction and how policy mechanisms bear upon them.

18. The potential for ambitious low carbon policy and regulation to create employment and commercial activity

- A range of views exist as to the additional employment opportunities and other benefits of low carbon policies. This has had high profile political attention, through CEMEP and in various country/EU stimulus packages.
- There are significant methodological challenges in estimating these benefits, such as the choice of an appropriate counterfactual.
- This study could seek to clarify these methodological issues and review the evidence for the costs and benefits of such programmes in a number of areas.

Annex 2 – Workshop attendees

<u>Last name</u>	<u>First name</u>	<u>Affiliation</u>
Andrews	Dave	Consultant/Claverton Energy Group
Archer	Greg	Low Carbon Vehicle Partnership
Argyropoulos	Daniel	Garrad Hassan and Partners Limited
Baker	Chris	Natural Environmental Research Council
Boston	Andy	E.ON Power Technology
Cox	James	Poyry
Flanagan	Brooke	Energy Saving Trust
Gault	Adrian	Committee on Climate Change
Greenacre	Philip	Imperial College/UKERC
Gross	Robert	Imperial College/UKERC
Hartley	Nick	Oxera
Hawkes	Adam	Imperial College
Heptonstall	Phil	Imperial College/UKERC
Joffe	David	Committee on Climate Change
Konar	Paro	Department of Energy and Climate Change
Lewis	Eric	National Audit Office
Lockwood	Matthew	Institute for Public Policy Research
Mabey	Nick	E3G
Meeks	Graham	CHPA
Mitchell	John	Chatham House
Moore	Alan	Renewables Advisory Board
Morrison	Tanya	Shell
Pal	Bikash	Imperial College
Pearson	Peter	Imperial College
Ploszek	Richard	Royal Academy of Engineering
Radcliffe	Jonathan	Energy Research Partnership
Skea	Jim	UK Energy Research Centre
Sorrell	Steve	University of Sussex/UKERC
Spiers	Jamie	Imperial College/UKERC
Steggals	Will	Scottish and Southern Energy
Steward	Fred	Brunel University
Taylor	Peter	International Energy Agency
Weatherley	Neil	Environment Agency
Winskel	Mark	Edinburgh University/UKERC