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Critical issues in UK low carbon energy innovation policy

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Workshop Report

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Sussex Energy Group
SPRU - Science and Technology Policy Research

THE UK ENERGY RESEARCH CENTRE

Operating at the cusp of research and policy-making, the UK Energy Research Centre's mission is to be the UK's pre-eminent centre of research, and source of authoritative information and leadership, on sustainable energy systems. The Centre takes a whole systems approach to energy research, incorporating economics, engineering and the physical, environmental and social sciences while developing and maintaining the means to enable cohesive research in energy. To achieve this UKERC has developed the Energy Research Atlas, a comprehensive database of energy research, development and demonstration competences in the UK.
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UKERC also acts as the portal for the UK energy research community to and from both UK stakeholders and the international energy research community. The National Energy Research Network (NERN), supported and facilitated by UKERC, acts as an umbrella network for energy researchers across all disciplines. The UKERC Meeting Place, based in Oxford, is a key supporting function of UKERC that aims to bring together members of the UK energy community and overseas experts from different disciplines, to learn, identify problems, develop solutions and further the energy debate.

SUSSEX ENERGY

The Sussex Energy Group (SEG) at SPRU (Science & Technology Policy Research) is a team of 16 researchers dedicated to understanding the challenges and opportunities for transitions to a sustainable energy economy. We undertake academically excellent and inter-disciplinary social science research that is also centrally relevant to the needs of policy-makers and practitioners. We pursue questions in close interaction with a diverse group of those who will need to make the changes happen. Core funding to the group is provided by the Economic and Social Research Council.

THE ENVIRONMENT COUNCIL

The Environment Council works to put environment at the heart of people's choices, decisions and aspirations. Our goal is to transform conventional decision-making to make environment as important as economics and politics.

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Executive Summary

Introduction
This workshop brought together 24 experts including policy makers, scientists and low carbon energy innovation policy stakeholders to provide a neutral forum, under Chatham House rules, for full and frank dialogue relating to recommendations emerging from low carbon energy innovation studies and current priorities and pressures in energy policy-making. This was an opportunity to reflect upon our various roles within the broader context of energy innovation policy. The aim of the workshop is to draw out robust insights for future energy innovation policy. The workshop outputs will inform a policy briefing to be launched by the Sussex Energy Group at a seminar held in London later in the year.

Critical Issues and Questions
The workshop explored four critical issues and posed the following associated questions:

1. Technology priorities and portfolio appraisal
    - 1.1 What are the key rationales and weaknesses of technology specific policies beyond R&D support and carbon pricing?
    - 1.2 What criteria should the government use to select the technologies it supports?
    - 1.3 What additional criteria should be used to choose the right portfolio of technologies to support?

2. Long-term signals and adaptable policy
    - 2.1 How can energy innovation policy provide stable incentives for low carbon innovation whilst remaining sufficiently adaptable to learn from experience?

3. Social innovation and technology fixes
    - 3.1 How can innovation policy attend to the social dimensions of the innovation process?
    - 3.2 What would be ways to encourage social innovations such as new business models, lower carbon lifestyles and changing behavioural patterns and routines?

4. Incumbents and outsiders in UK energy innovation policy
    - 4.1 How can policy-makers support a broader variety of incumbent and outsider innovators?
    - 4.2 How can the development of innovation policy be opened to a wider set of stakeholders?

These four critical issues and associated questions were chosen by the Sussex Energy Group because they reveal tensions and trade-offs in the development of low carbon energy innovation policy and thus lend themselves to constructive thinking about a variety of future strategies.

Workshop Process
To address the questions, most of the time was spent in small working groups, with occasional opportunities for plenary discussion. For each of the four issues,

discussion was recorded on flip chart paper and summarised on pre-defined poster templates. The final synthesis discussions provided for review of the work of all groups on each issue. This report reflects the written record of the two day workshop.

Key Messages

Several key issues were identified in the final plenary as important messages for the Sussex Energy Group to take away from participants:

1. Better support for social entrepreneurship required;
2. Emphasis on technology and behaviour change required in tandem;
3. A whole-systems approach to innovation required, encompassing technology, behaviour change, entrepreneurship, among others;
4. Defining low carbon innovation policy is still contentious and remains a key question.
5. Continued work on synthesising the work done at the workshop is required – can the four issues discussed by brought together?
6. Keep policy focussed on outcomes, but keep means to achieving low carbon energy policy open.

Organisation of the report

The report begins with a backgrounder to provide the context for the workshop and introduce the critical issues. This is followed by the opening remarks of the Sussex Energy Group deputy director Jim Watson. An overview of Issue 1 is given followed by a summary of group discussions. Issue 2, 3, and 4 follow, each with an issue overview followed by summaries of the small group discussions. A summary of the synthesis sessions is provided, followed by notes of the final plenary discussion and closing remarks. Appendices 1-4 contain the raw notes from all group discussions and each appendix corresponds to an issue (i.e. Appendix 1 contains the flip chart notes from Issue 1: Technology priorities and portfolio appraisal). Throughout the document there are process notes, highlighted in shaded boxes with the following symbol:

Appendix 5 contains the workshop briefing note, Appendix 6 is the workshop programme, Appendix 7 contains the group allocations, Appendix 8 lists participants, affiliations and email addresses and Appendix 9 contains a summary of the participants' evaluation.

Throughout the report, spellings have been standardised, abbreviations spelled out and punctuation inserted where it may help to clarify meaning. In some instances, clarification was sought from participants and has yet to be obtained.

Contents

Workshop Background

by Adrian Smith and Florian Kern, Sussex Energy Group

The aim of the workshop was to draw out robust insights for future energy innovation policy. The workshop outputs will inform a policy briefing to be launched by the Sussex Energy Group at a seminar held in London later in the year.

Context

A range of institutions, policies, and programmes dedicated to promoting low carbon energy innovation have emerged in the UK in recent years:

- There are bodies, new and established, such as the Energy Technologies Institute or the Carbon Trust.

- There are new policies for research and development support, low carbon demonstration, and market creation, such as the Marine Deployment Fund, the Low Carbon Buildings Programme, or the recently announced Environmental Transformation Fund.

- There are initiatives that provide strategic oversight and input to energy innovation, such as the energy Foresight panel, and the Technology Strategy Board.

Ministerial statements regularly announce additions to the growing list of low carbon innovation policy initiatives.

Whilst contributing a helpful diversity in low carbon innovation activity, the recent layering of initiatives and emerging institutional complexity poses considerable challenges regarding long-term strategy, co-ordination and learning. The Government recently announced, under the Comprehensive Spending Review, it was developing a new low carbon technology strategy to be launched in 2008. The workshop provides a timely opportunity to discuss future strategy in this area by drawing together research insights and the experience of practitioners in the UK.

Critical issues

The two-day residential workshop allowed participants to explore critical issues confronting UK energy innovation policy and the opportunities and challenges they present. Each issue, outlined below, was introduced by members of the Sussex Energy Group, drawing upon recent research in areas such as micro-generation, technology appraisal, low carbon technology transfer, eco-housing, strategic green niches, energy system transformation, energy scenarios and transitions research. The critical issues have been chosen because they reveal tensions and trade-offs in the development of low carbon energy innovation policy and thus lend themselves to constructive thinking about a variety of future strategies.

The identified issues were:

1. Incumbents and outsiders in low carbon energy innovation policy.

How can innovation strategy be developed that draws upon the resources and experience of incumbent energy businesses but that simultaneously permits space and support for new, low carbon energy entrepreneurs? How can energy innovation policy networks be opened to a wider set of players (small entrepreneurs and civil society stakeholders) and involve them in strategising? What intermediary strategies can capture the complementary roles and interests but also manage the potential tensions and conflicts?

2. Long-term signals and adaptable policy.

Business often seeks relatively stable policy frameworks with clear, long-term goals within which they can work, invest and develop. And yet research into risk and sustainable innovation recommends policies that are adaptable to emerging circumstances and the unanticipated consequences of earlier policies. Meanwhile, the pressure for policy-makers and developers to demonstrate success can obscure valuable lessons arising from failures. How can energy innovation strategy reconcile this tension between certainty and flexibility?

3. Technology priorities and portfolio appraisal.

On what grounds should we prioritise support for low carbon energy technologies, and which criteria should we use for appraising portfolios? How can we make sure low carbon technology priorities remain congruent with broader and dynamic objectives in industrial policy, social policy and sustainability policy?

4. Social innovations and technology-fixes.

How do we make sure innovation strategy attends to the social dimensions of sustainable energy innovation? Recognising the social dimensions of innovation processes is essential: the skills, networks, ideas, financial expectations, and so forth that underpin the development of new energy technologies. However, innovations can also be social in nature, such as car clubs, personal carbon allowances, that involve social changes, organisational innovations and new lifestyle expectations and routines. How should a balanced innovation policy promote both the social innovations and the technology artefacts that enable the widespread deployment of low carbon energy practices?

The ambition was for the workshop to provide a little distance and relief from the day-to-day work pressures. We hoped participants would leave with some new insight and oversight as to their own roles, the views of others, and with a better appreciation of how the current layering and complexity in policy could be harnessed to more strategic effect.

Opening Remarks

By Jim Watson, Deputy Director of the Sussex Energy Group - Workshop Chair
A PDF version of Jim's presentation can be viewed here.

Jim gave an overview presentation and introduced the aims and purpose of the workshop as follow:

Aims

1. Bring together research perspectives and practitioner experiences in UK low carbon innovation policy;
2. Draw out robust insights for future energy innovation policy;
3. Identify further research requirements which would be useful for policy and/or research communities.

The objectives of the workshop are to:

1. Learn about leading ideas in energy innovation studies;
2. Debate policy recommendations coming from the research community;
3. Contrast research insights with day-to-day realities;
4. Share experiences with others involved in innovation policy; and
5. Contribute ideas for future energy innovation policy

Jim provided a context for why policy for low carbon innovation matters by explaining the UK policy context, as well as the current funding and institutional landscape. Currently, there are a multitude of organisations and institutions involved without full clarity on their collective boundaries and synergies. From a funding perspective, there is a decided increase in funds directed toward low carbon innovation.

Regarding what is meant by low carbon innovation policy, Jim explained that

- Innovation covers the spectrum from research and development to early deployment;
- Innovation is not a linear process – it is networked and involves multiple relationships between actors;
- Increasing recognition that innovation policy has a role to play at many of these stages of development; and
- Innovation includes the development of new technologies and their embodiment in products; but also associated social, institutional and organisational developments

The following four critical issues were selected for discussion at this workshop as they occurred frequently in Sussex Energy Group's work in the UK and internationally and represent significant tensions for policy-makers as there is no clear-cut or 'best' policy solution for balancing the trade-offs:

1. **Technology priorities and portfolio appraisal**
   How should innovation priorities be chosen?
2. **Long-term signals and adaptable policy**
   How should innovation priorities be adjusted?

3. **Social innovations and technology-fixes**
   What kind of innovation should be encouraged?
4. **Incumbents & outsiders in low carbon energy innovation policy**
   Who will innovate?

Jim explained that each critical issue would be dealt with in turn by participants in teams; with each issue introduced in turn by the organisers. The small working groups will follow facilitated exercises leading to policy recommendations. Regular plenary sessions will provide for discussion between groups. A final exercise will seek to synthesise the insights generated under each issue and make recommendations for a more integrated and strategic approach to energy innovation policy.

Issue 1: Technology priorities and portfolio appraisal

Topic introduced by Jim Watson, Sussex Energy Research Group

Introduction

Q1 What are the key rationales and weaknesses of technology specific policies beyond R&D support and carbon pricing?

- Historic reluctance to do this: 'avoid picking winners'
- But policy has shifted – technology specific policies now common

Q2 What criteria should the government use to select the technologies it supports?

- Different rationales given for different support policies
- Rationale for presence / lack of support not always clear

Q3 What additional criteria should be used to choose the right portfolio of technologies to support?

- Portfolios have properties in addition to those of their constituent technologies

Workshop participants broke into four groups to address all of the questions in parallel. Key points of the discussion were recorded on a poster template and any other discussion points were recorded on flip chart paper. A participant from each group was elected to report back in the review session.

What criteria should the government use to select the technologies it supports?

Red Group – click here for discussion notes
Important **criteria** the government should use **to select** low carbon **technologies**
• UK capacity to develop, use and make £ out of it

- Match to UK industrial strengths (weaken…)
- Liberal IP rules should apply
- Maximum contestibility for development
- Potential for widespread deployment
- Transformative potential of the technology (e.g. smart meters)

Risk and uncertainty

- Why is no one else supporting it?
- Robustness go change in Macro environment
- High risk – high return
- Portfolio of high risk and low risk options

Important **additional criteria** for choosing the right **portfolio** of technologies

Comparative advantage (this stretches over both boxes!!)

- Natural resources e.g. Wind, tide, coal
- Balancing intern. Collaboration with national appropriability
- Synergies across knowledge base
- Build on comparative advantage (or competitive)

Policy agenda

- Match to other measures
- Synchronise with climate change committee

Dynamic

- Regular independent review of portfolio Mix
- Portfolio to reflect different users e.g. local vs. central
- With the scale of climate change, there is no "right portfolio"

Pathways

- Easy wins and longer-term transitions
- Position on "roadmap" – enable something else to happen e.g. smart meter
- Mix disruptive/incremental
- Mix of short-term and long term options
- Full scale of technology readiness short-medium-long-term strategy
- Supply side – demand –side implications – contradictory worlds.
- Short term impact (and cost of doing it) awareness/symbolic
- Diversity, disparity, variety, balance

Risk cost diversity

- Do not bet the bank ala "cold fusion"
- Mix of high risk and low risk options
- Balance big-small

Yellow Group – click here for discussion notes

Important **criteria** the government should use **to select** low carbon **technologies**

- UK competitive vs. international co-operation
- Bring to market mature technologies vs. binging new technologies to maturity
- Recognise need to optimise costs in recognition of full spectrum of costs. Environmental, Social, Economic, life-cycle, technology learning.
- Perceived resource constraints – present and future
- Possible ethical trade-offs with resources for other objectives e.g. health
- Complementary – seasonal demand – other existing technologies – other sectors (heat, electricity, food, transport)
- Informed by assessment existing capital stock system inertia, lock-in, key decision points (e.g. 2030 etc.)

Important **additional criteria** for choosing the right **portfolio** of technologies

- Complementary – short and long term – mature and future tech
- Interaction options (be aware of) – distractions, regulations, resources. Unforeseen
- Risk – Ok for things to fail – learning
- Diversity
  - what kind
  - disparity,
  - balance
- security – system level
- resilience – inc. adaptation
- urgency –
  - need to be revolutionary vs. incremental
    e.g. zero C housing by 2016
  - Order of magnitude changes require
  - Change of business model required e.g. energy service companies
  - Comparison with telecoms. Service packages vs.
- Government referee vs. groundsman

Green Group – click here for discussion notes

*Important **criteria** the government should use **to select** low carbon **technologies***

- Carbon saving potential(long run facilitates w.??? action)
- UK benefit – (arrow) Economics and leadership and capacity building
- In line with social political consensus

*Important **additional criteria** for choosing the right **portfolio** of technologies*

Enabling technologies – (arrow) flexibility to adapt to unpredictable future
– Enabling (arrow) network infrastructure.

Complementing technologies (DSM/renewables
Balance of supply –side demand side technologies.

Blue Group – click here for discussion notes

*Important **criteria** the government should use **to select** low carbon **technologies***

1. Is the UK the right place to do this innovation can we buy in technology?
   potential for building UK industry in this area/technology
2. Security (e.g. resource/technology
3. Flexibility for updating technology as efficiencies improve (e.g. wind turbine and combined with tidal
   reliability of technology
4. Contribution to energy security
5. useable by all income groups (or associations of users
   not only Co2 other issues to be addressed
6. Green House Gas emissions per unit of electricity, heat, transport fuel produced (incl. whole life cycle)
   other environmental impacts than emissions (visual impact, impact on biodiversity…)

less energy and resource use in whole life cycle
life cycle implication outside UK boundary)
7. consistent with vision for "low-carbon" energy system
long term system may be centralised or decentralised
8. Urgency – speed of installation (6months or 12 months) for nuclear – PV plant for District electricity by Nanosolar in 6 months
Infrastructure involved or use of existing (e.g. energy from waste to a hospital or freeserpl. Or to grid or railway
9. risk profile of technology (e.g. scale of effects in case of accident)
10. Long term cost-implications
reasonable expectation of long-term cost effectiveness
11. Infrastructure – if technology can take advantage of existing infrastructure, it could come on stream quicker (however, need to temper this – the infrastructure may be wrong and need changing

Important **additional criteria** for choosing the right **portfolio** of technologies

Issue 2: Long-term signals and adaptable policy

by Florian Kern, Sussex Energy Group

Introduction

Tension exists between innovation policies giving clear and stable long-term signals and the demand on policies to be adaptable

Stable policy frameworks are important:

- to give stakeholders a clear sense of long-term direction
- to reduce risks for investors
- to accumulate knowledge and align R&D agendas

Flexible policy frameworks are important:

- to hedge against uncertainty, contingencies and unanticipated consequences of policies
- to provide room for policy learning

A good illustration for this tension between stability and flexibility is the recent discussion about EU biofuels policy. While the EU commission with its biofuels directive tried to create a stable policy framework which provides the market with faith in the future growth of biofuels this policy has sparked debate about the sustainability of options such as imported palm oil. On the one hand the directive hoped to provide stability through its targets but at the same time learning about potentially averse effects of biofuels production make it necessary to be flexible e.g. about the goal itself or at least in terms of clarifying the policy by putting in certain sustainability criteria, including social and environmental issues. This is an example for the necessity to adjust a policy setting to take learning and new research findings into consideration which means policy needs to be flexible.

Question:
How can energy innovation policy provide stable incentives for low carbon innovation whilst remaining sufficiently adaptable to learn from experience?

Participants were divided into four small working groups. Two of the groups spent an hour discussing policy certainty and two of the groups spent an hour discussing the need for flexibility in policy. These discussions were recorded on flip chart paper and summarised on the posters below.

Certainty

Identify the advantages and disadvantages of certainty in low carbon energy innovation policy.

Green Group – click here for discussion notes

Why is certainty important in innovation policy? For whom?

1. Justifies long-term investment decisions
2. more carbon – efficient products

Industry investment sector policy makers

What are the drawbacks of too much certainty?

- "putting all your eggs in one basket"
- Uncertainty favours the innovator
- Unexpected /unintended consequences
- Opportunity cost
- Lock –in
- Windfall gains leading to questions of credibility

Provide examples of policy instruments that provide certainty in low carbon energy innovation policy. How do they achieve this certainty?

1. ETS
2. renewables obligation
3. general emissions legislation at UK and EU level

vehicle standards

Yellow Group – click here for discussion notes

Why is certainty important in innovation policy? For whom?

- Very uncertain general conditions prevents new build of any kind e.g runs risk of system failure
- Certainty is important for investment decisions but its destinations or ends that need to be certain : means can change
- Political Consensus – agreement on the message from the scheme – will allow for more radical innovation forms of energy?
- Continuity of learning process and innovation
- Allows private investors to support (emerging innovations)
- Social consensus about urgency of the problem

Comment [FK1]: Change? Innovation?

- Business/people know what needs to be done (if penalties are significant) penalties must be serious
- Investment social buy-in credibility
- Developers in technologies that are some way from market
- Including those setting priorities for basic applied research
- Certainty of outcome is important – otherwise any measures will get heavily discounted in investment decisions. Absolute carbon price not important- gas, electricity and carbon price can all be dealt with in sensitivity analysis. It's the direction of travel that's important

What are the drawbacks of too much certainty?

- Can't fix unintended consequences or abject underperformance
- Now-optimal ways of reading targets (better solutions may emerge in interim)
- Lack of room for surprise/lack of incentive for radical innovation
- May disable development of outsider/disruptive technology if pathway is too defined (but certainty of outcome is OK)
- Certainty of goals but flexibility of tactics

Provide examples of policy instruments that provide certainty in low carbon energy innovation policy. How do they achieve this certainty?

- Need to be aware we have a history of setting targets too low to solve the problem – if we are to offer certainty it needs to be high i.e. 60% by 2050 is long out of date
- Tradable Energy Quotas
- Mandatory condensing boilers – clear standard to meet – why not for power stations too?
- Political tendency for certain long term changes – just not in this term of office
- Certainty can be achieve in term of an improvement in efficiency, from a mandatory standard (boiler, fridges) but certainly of overall consumption is much harder
- Improvements in efficiency have been outweighed by increases in service demand for 3 decades !!! – rebound
- So many overlapping policy instruments have emerged recently, I suspect there aren't any
- Future demand for low-carbon technology is broadly assumed by frequent and (fairly) consistent govt statement on UK overall policy
- Future EU emission standards for vehicles with progressive tightening
- FIT And RO
  no-single mechanism can create certainty grid consent, planning
  some improvement of CHP

Flexibility

Identify the advantages and disadvantages of flexibility in low carbon energy innovation policy.

Blue Group – click here for discussion notes

Why is flexibility important in innovation policy? For whom?

- Flexibility important to policy makers and some innovators
- To be able to learn from experience
- Policy needs more flexibility on individual solutions, less on goals

What are the drawbacks of too much flexibility?

- Lots of flexibility can equal uncertainty
- Flexibility could disadvantage some technologies e.g. long live/high capital cost
- May need to limit areas of flexibility within policy framework
- Too much flexibility is not good
  - Lack of investment
  - Lack of R&D
  - Lack of Confidence
- Investors prefer stability of policy incentives too much flex – lack of investment

Provide examples of policy instruments that provide flexibility in low carbon energy innovation policy. How do they achieve this flexibility?

- Japanese top runners programme
  dynamic standards
- Stable long term targets *can* provide a framework to stable policies
- Carbon price/tax very flexible
- Flexibility possible within different instruments
  - Tax
  - Obligation
  - Regulation
- Rolling budgets in climate change bill
- Banded support schemes, e.g. reformed Renewables Obligation can offer some flexibility within stable structure

Red Group

Why is flexibility important in innovation policy? For whom?

- Won't get it right first time
- To enable learning
- Tao allow targeting of instruments Policies often not designed within learning and review in mind – hubris

Circle of Policy, learning, action and review

What are the drawbacks of too much flexibility?

- Flip flop policy
- Chills large investment
- Might dilute impact
- Undermines continuity
- Confuses and pisses off players e.g. applicants

Provide examples of policy instruments that provide flexibility in low carbon energy innovation policy. How do they achieve this flexibility?

Flexibility examples

Energy efficiency commitment EEC 1+2 –required short-term payback – very inflexible CERT (carbon emissions reduction target)

- Both established technology and pot of £ for "technical priority group" - to assist with emerging technologies
- This is an e.g. of evolution and learning in policy – flexibility in best available technology (BAT) Not entailing excessive costs – pollution

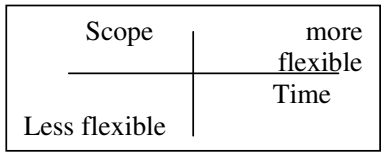
regulation and review of what is "BAT"

EU ETS 1+2
Overly flexible – country delegation re cap let to over allocation and "C down 0 and phase 3 – (arrow) positioning and tighter caps so some flexibility

Climate change bill in 5 year blocks – flexibility annual targets would be too inflexible
_____-
LCBP – not enough flexibility initially has - (arrow) for much review and certainty now?

Fuel tax escalator – Brittle

UK research councils responsive mode – not restricted flexibility but no continuity
By contrast, Tech programmes are more focused and more certain but less flexible
Importance of setting agenda
Breadth of portfolio and techs + size of grant



Carbon Trust low – acceleration programme
Open to all low –C techs within their low-c assessment (reviewed every 2-3 years)
Time limited schemes, changing criteria e.g. lottery funding
Criteria too narrow/fixed vs. criteria general and open
Branding re degrees of flexibility to allow learning
Tightening over time
Islands of flexibility e.g. Ofgem transmission and distribution for network - for embedded generation – good but may be inadequate.

Independent periodic review and learning hooked into policy design
e.g. RC's reviews, BATNEEC
2003 Energy White Paper allowed for regular review
Emissions control in car industry – negotiated incremental but gave certainty and produced results
VED and fuel tax working in tandem

Following the discussion above, participants formed two semi-plenaries by having certainty group Green join with flexibility group Blue and certainty group Yellow join with flexibility group Red. Each group was asked to discuss and develop policy mixes that combine certainty and flexibility.

Developing policy mixes that combine flexibility and certainty

Blue/Green – click here for discussion notes

How can policy makers combine the advantages of certainty with the advantages of flexibility? (provide examples)

- Innovation stimulating by necessity – carbon price /tax how to use ETS/RO as Stimulus
- The importance of getting the market right as a driver for innovation

- Broader approach to L.C innovation – (arrow) create longer term incentives on key market players to drive innovation (e.g. energy suppliers, renewable obligation and supplier obligation)
- Flexibility in short-term alongside long-term market certainty (can we depend on current commitments)
- Household – Community-District All as units of analysis – not just product or technology
- Creating best possible selection environment – networks of scientists, products, ???, policy makers and mechanisms And financial investors
- "Independent" body and network to monitor development paths (closing phase + lock-ins maintaining best possible selection environment and avoid market failure
- **Long-term certainty/Short term flexibility**

Can you provide examples where low carbon energy innovation policy has got the combination right, and explain why this works?

- Branded Renewables Obligation (possibly)
- Examples of success (primarily international) dependent on local market conditions – are they just "lucky strikes"?
- General need to consider wide range of energy policy instruments. In terms of innovation potential, even where not badged as innovation
- For future explore gradually tightening reg. standards for stability and flexibility
- Arguably U the supplier obligation has driven energy suppliers to start to innovate in products and push e.g. smart metering

Can you provide examples where low carbon energy innovation policy does not have the right combination, and explain how to improve the balance between flexibility and certainty?

- Lack of experience of low carbon innovation policies in UK context
- Renewables obligation before banding

Flexibility facilitates incremental innovation but certainty of long term targets require radical innovation.

Red/Yellow – click here for discussion notes

How can policy makers combine the advantages of certainty with the advantages of flexibility? (provide examples)

- Zero Carbon in 20 years!!
- Carbon price (international)?
- Nested topology, certainty of goals , flexibility increasing at lower levels of tactics but maximising "certainty", the lessons learned
- long term goal with review timetable
- seemingly clear goals
- Fox long term overall target, review detailed operation every 3 years.
- Clear framework of expected outcomes and goals, plus adaptable reviewed implementation.
- Institutionalise process of review and learning
- Clear goal with room for manoeuvre
- Banded scheme – technology moves up bands in time,
- Certainty in overall strategic framework and certain outputs and flexibility in implementation e.g. residential Council targets to increase spend on energy from £40 M to £70 M (04-07) Mix of mechanisms

Can you provide examples where low carbon energy innovation policy has got the

combination right, and explain why this works?
• Energy labelling scheme • Car emissions? Long term clear reviews and ratchets on technology but not CO2 • TEQs • Congestion charge – clear aims – Transparent (ish) updates • EEC – Cert • Transition – evolution • RO. – reviews offer flexibility - grandfathering provides certainty • EEC / Cert – decision on means left to companies
Can you provide examples where low carbon energy innovation policy does not have the right combination, and explain how to improve the balance between flexibility and certainty?
• NFFO • Clear skies / LCBP transition • Renewables obligation – lack of flexibility in short term - lack of security in long-term • European emissions trading scheme • EEC/CERT/SO • Long term target regular reviews • All grant programmes are too short in their perspective – low carbon BDG programme – PV programme - DTI biomass programme - Community energy • Marine deployment fund – wrong balance between Market –pull and tech-push (beware of over-expectations) • VAT on micro CHP exemption had no impact technology not ready set time • Clear skies CRI, etc. transition from clears skies to LCBP transition – very disruptive • LCBP – longer time horizon from scheme • EU vehicle standards – mandatory /sanctions • Voluntary agreements (cars. Appliances) are too short term. Need to be mandatory standards! (on U.S model for appliances)

Issue 3: Social Innovations and Technology Fixes

introduced by Dr Adrian Smith, Sussex Energy Group

Introduction

An open question for energy innovation policy is how to support, incorporate and learn from those new social initiatives that are quite different from mainstream business or social practice, and how to help to translate those ideas into wider consumption and production practices. This might simply involve energy innovation policy-makers working more closely with other policy domains, and provide helpful lessons about the way new ideas and socio-technical practices spread and exert

influence. Or it could involve an extension of innovation policy into these social domains.

Two questions were put forward to workshop participants:
3.1 How can innovation policy attend to the social dimensions of the innovation process?
3.2 How can policy encourage social innovations?

Participants were divided into two groups (A and B) and asked to respond to the two questions noted above. Regarding question 3.1, each group had a general discussion and then summarised their thoughts on a poster. The poster for each group is listed below and the notes from the discussion can be found in Appendix 3.

3.1 How can innovation policy attend to the social dimensions of the innovation process?

Group A – click here for discussion notes
Important social dimensions underlying technological innovation and why are they important?

Dimension — why important?/What role do they play in innovation processes?

- Individual
- Communities
- Society
- Market
  - incumbents
  - innovators
- Tradable energy quotas freedom vs. nanny state – limits to choice
- Low carbon 'observatory'
- Where to go to see what's happening
- National network of 'open' or demonstration projects
- Installer skills
- To build markets and overcome consumer distrust

How does policy already attend to these dimensions?

Info and advice // Regulation e.g. local waste recycling targets

What can energy innovation policy do to strengthen these dimensions?
Brainstorm of possible policy actions/packages (list below)

- Make it aspirational
- Start up funding for e.g. solar/car clubs
- Open/demo house schemes like grant to stately homes
- Trigger word of mouth, peer to peer e.g. compost district "nurse"
- Regulatory reform- incentives for services

Group B – click here for discussion notes
Important social dimensions underlying technological innovation and why are

they important?
Dimension why important?/What role do they play in innovation processes?
How does policy already attend to these dimensions?
What can energy innovation policy do to strengthen these dimensions? Brainstorm of possible policy actions/packages (list below)
❖ Support research into relevant tools dissemination/their adoption ❖ Innovation policy makers need to lobby other policy sectors e.g. training and skills ❖ Importance of "place" in low carbon innovation – household /transport/???? ❖ Greater consultation with bottom – up solutions ❖ Intellectual property open innovation model?

Based on the group brainstorms above, participants were asked to work in two or three smaller groups to develop two policy actions that would support the social dimension of innovation processes using the pre-defined poster template. The results of these policy packages are shown below.

Policy Action Proposals

1. Neighbourhood demonstration award scheme

Policy description

Home/firm submits application to put in an innovative/non-standard low-carbon technology. Winners (some chosen on TV – a low –carbon 'X-factor' or green dragons den) get the public funding (from TBC). In return they host a set number of open days and participate in other publicity e.g. you tube

Rationale and aim of this policy

- ❖ More demonstrations in real – life contexts
- ❖ Peer to peer networking – more effective than top down, taps into the UK love of seeing peoples' homes
- ❖ More public demand – more investment/less risk
- ❖ Learn from both success and failure
- ❖ Creates a buzz, makes cc tech aspirational and available and familiar

Who is required to do what/resources required

- ❖ Government stumps up the cash (or lottery)
- ❖ Panel selects award winners
- ❖ Applicants work up bids and get grass roots support
- ❖ Winners hold open days and participate in other publicity
- ❖ (a few iconic ones on TV but others too so that it's easy to visit one)

Timeframe in which the policy could be developed/lead to results

- ❖ 18 – 24 months
- ❖ Successive rounds with evolving aims

Potential difficulties and what can be done to mitigate them

- ❖ Need to distribute technologies and sites evenly
- ❖ Watch out for scams – but accept some failures, transparent financial

management (no rerun of ICA's)
- ❖ Devolved administrations / state aid issues

2. Improved visualisation of energy consumption/waste

Rationale and aim of this policy

Helping people to understand energy issues – improve engagement , take –up

Who is required to do what/resources required

Improved access to data
Communicating it in meaningful and engaging way

Timeframe in which the policy could be developed/lead to results

Policy could be developed quickly
Results will depend on social change

Potential difficulties and what can be done to mitigate them

80 years turnover of population – retraining of mind-sets!!

3. Support research into relevant social policy tools

Policy description

- 1. process 2. tools
- include their dissemination / adoption
- Background unexploited potential. Use of energy tools (e.g. MCDA), and their use/ uptake in energy industries
- Both project tools and portfolio tools

Rationale and aim of this policy

- Broader understanding of impacts of policy from other areas within current modelling activity
- Development of industry relevant tools
- Adoption of tools which can effectively support future development particularly in portfolio scenario
- Existing tools don't capture full range of factors affecting success and failure of new projects
- Addresses acceptability and behaviour alongside traditional cost benefit and LCA analysis

Who is required to do what/resources required

- Evaluation of most appropriate tools and their applications
- RC's funding development of relevant tools
- ETI/TSB funding demonstration of application
- Industry collaboration to assist development of tools and ensure dissemination /application
- Use of tools by "policy influencers" e.g. RAE

Timeframe in which the policy could be developed/lead to results

- Development of tools in short-term. Application in short-medium term

- Cycle of development application and improvement

Potential difficulties and what can be done to mitigate them

- Engineers don't talk to social scientists
- "language" difficulties , bring the right people together to collaborate
- Social scientists – engineers/scientists – modellers bring them together
- Understanding of need availability of solutions
- Building reviews and learning
- Commitment to change following interaction

4. Catalysing local low carbon innovation from below
Policy description
❖ a national policy framework ❖ Example ❖ Community renewables initiative. clear skies community
Rationale and aim of this policy
Observe social innovation happening learn from this and encourage replication
Who is required to do what/resources required
❖ At local level – find your examples / capability /capacity ❖ Facilitate learning and sharing of ideas/experiences ❖ Imaginative funding options to incentives delivery.
Timeframe in which the policy could be developed/lead to results
❖ Co-ordinating between policy levels (local, regional, and national) 12 months ❖ Resource flows (money and lessons????) down and across in 3 yr. cycle)
Potential difficulties and what can be done to mitigate them
Evaluation criteria - Tail came to wag the dog : projects designed to fulfil criteria of local ideas

At the end of this session, posters were displayed on a graffiti wall at the back of the room and participants were invited to review each other's posters and policy actions. Post-it notes were made available for participants to add comments to the ideas presented.

Interim Evaluation Day 1

Participants were asked their thoughts on the workshop so far and for suggestion for improving the format on day 2. Responses were recorded on flip chart paper.

What do you think about the workshop so far?

- You are successfully pursuing a demand-led approach to workshops!
- Great, more of the same
- Morning session on criteria - not enough time to get into the topic
- It's been good when people have provided real life examples that the learning can then be drawn from – good.

What could we change to make tomorrow better?

- Approach – let's stick to this
- We know what technological innovation is but not what social innovation is

  Has this been challenging for everyone?
  - ❖ It felt like a very big question to be answered in one session
  - ❖ Quite hard to pin down what social innovation is

- Important to have social innovation within the remit of this group and to explore it:
- Social innovation sessions may need to be more content driven – more presentations and structure needed.
- We're not so at ease with the policies that drive social innovation–but need to be
- Not many people know about social innovation in the energy world – it needs development
- Social innovation seemed more abstract than technological innovation but my group got a lot out of it once we'd had time to discuss.

- Would have been useful to unpack the definition of energy technology innovation – it's the starting point.

Issue 4: Incumbents and Outsiders in Low Carbon Energy Innovation Policy

by Gordon MacKerron, Sussex Energy Group

Introduction

Two related but distinct issues here:

A. How can policy help broaden the variety of innovators and innovations?
B. How can a wider range of stakeholders be involved in policy-making?

A. Insiders and outsiders in innovation
   - Need for radical as well as incremental innovation
   - 'Radical' can equal 'disruptive' and may be difficult for incumbents
   - Outsiders may be small/flexible but can also be large firms in other fields

   Question:
   How can policy-makers support a broader variety of incumbent and outsider innovators?

B. Broadening the range of stakeholders engaged in policy development
   - Large incumbents are more willing/able to participate
   - Partnerships as a key favoured mechanism
   - Design and scope of partnerships are a major issue: how to provide incentives for small/outsiders/disrupters to participate, and to resolve potential antagonisms?

   Question:
   How can the development of innovation policy be opened to a wider set of stakeholders?

4.1 Strengths and weaknesses brought to low carbon innovation

Participants were divided into two groups (A and B groups) and were asked to write whom are the incumbents and outsiders in low carbon innovation. These post-its were clustered, and then participants were asked to list the stakeholders' respective strengths and weaknesses regarding low carbon innovation. The group subsequently discussed how the strengths of all stakeholders could be harnessed strategically by policy.

Group A – click here for discussion notes

Incumbents	Strength	Weakness
Removing CO2 from air – doesn't fit? Meat – no incumbents? Lacks regulation	Certainty of delivery	More radical innovation, e.g. 60% down needs more players? Disruptive innovation damages their own market
Outsiders	Strength	Weakness
		Uncertainty on delivery (can disrupt innovation)
Exercise: Provide ideas or examples for how the strengths of both kinds of innovator can be harnessed strategically by policy?		
❖ Policies that encourage disruptors e.g. feed-in tariffs. ❖ [More open policy?] – Policy usually about incumbents and getting them to do something, ❖ Closer link with competition policy? ❖ Obligation to focus on outcome, not spend £.		

Group B – click here for discussion notes

Incumbents

Within existing markets

- Electricity utilities
- DC Transmission
- International innovators
  - Incumbents in many areas of energy
  - Risk that we keep them as outsiders to UK developments
- Energy companies
  - Oil majors
  - Utilities
  - OEMs
- University research base actively involved in energy sector
- Energy SMEs
  - University spin-offs
  - Developers of technology
  - Offshore engineering?
  - Consultants

Strength

- Cash & people
- Issue awareness
- Incumbents important in delivering resources to meet need
- Incumbents positive capacity / problem-solving
- Incumbents know the industry – opinion formers
- Electricity utility: knowledge of retail market, investment capacity/resources, technology buyers → demand impact

Weakness

- Mindset
- Inflexible procedures – hidebound
- Engagement with network of incumbents is resource intensive
- Electricity utilities:
  - constrained by existing business models and strategies
  - constrained by meeting existing customers
  - organisational inertia
- Incumbents have a lot to loose from disruptive innovation, risk averse, conservative, shareholder value risk

Outsiders

Outside / Having a hard time breaking into markets

- University research base with transferable skills, e.g. social science
- External supply chain – SMEs with transferable skills (under exploited)
- Green tariffs
- Metering innovation
- Biomass / CHP
- Solar 'storage'
- Carbon trading
- Watson Smart display
- Volume house builder
- ICT companies outside energy field

Strengths

- Strong influence on final energy demand
- Problem focus
- Outsider less conventional
- Nothing to lose, motivated

Weakness

- Lack of inclination and capacity for low carbon energy innovation
- Poor link to market
- Little cash and expertise
- Less conventional
- Lack of funds, expertise, market 'nous'?; pre-systems integrator stage tough to grow

4.2a How can the development of innovation policy open to a wider set of stakeholders?

Participants were divided into two groups (A and B groups) and were asked to write whom are the incumbents and outsiders in low carbon innovation. These post-its were clustered, and then participants were asked to list the stakeholders' respective strengths and weaknesses regarding low carbon innovation. The group subsequently discussed how the strengths of all stakeholders could be harnessed strategically by policy.

Group A – click here for discussion notes

Comment [FK2]: Link not working

List examples of stakeholders; identify the extent of current involvement; and the contribution the (can) make to policy development.

Type of stakeholder	**Current involvement**	**Contribution to policy development**
Lots	Through consultation	Limited?
A few →	Dinner	Lots
NGOs →	Media	Sometimes nothing
Trade associations/NGOs	Private Members Bills	Sometimes lots Acts of Parliament i.e. 1. Sustainable & Secure Buildings Act 2. Climate & Sustainable Energy Act (set agenda for microgen)
Westminster 'Half mile' community Consultancy EST/Carbon Trust Professional associations Academics	T.A. Analysis Expertise £ Policy memory → GOBSATT Framing ideas Consultancy / Analysis	Frame and assess policy options Outrageous Content and process
Select Committees	Analysis Transcend boundaries	

Group B

List examples of stakeholders; identify the extent of current involvement; and the contribution the (can) make to policy development.		
Type of stakeholder	*Current involvement*	*Contribution to policy development*
Planners	Medium	Contribute standards & guidelines Currently – technology (delay) following Potentially – technology enabling (better co-ordination with developers)
Regulators	High	i.e. OFGEM: tariffs, market rules, network access Building regulations – like planners Potential: adapting their institutions to low C innovation
Regional Bodies, e.g. RDAs	Medium	Regional intelligence & knowledge about niche opportunities → could be done better (regions communicating more and centre listening)
National 'Quangos', e.g. Carbon Trust	High	Lots of activity Gaining authority Tons of money Reflect on practice
Energy Companies – Oil companies, Utilities	High	Generators: ▪ Market ▪ R&D ▪ Resource ▪ Expertise
NGOs	Medium	Longer term view, unconstrained ideas, scenarios outside the box, people raising Represent future generations
Local Citizen groups, e.g. Transition Towns	Low	Potential for encouraging active engagement of citizens in innovative solutions Local citizens: unfocused, uncoordinated, little contribution to innovation generally, however, Transition towns is exception
Supply Chain SMEs	Medium	Too busy surviving to address innovation policy
Supply Chain OEMs	High	Potential to input, not necessarily in support of innovation
Installers (supply chain)	Low	None
Project Developers, e.g. CHP, Renewables	Medium	Effective lobbying: ▪ See shape of original RO ▪ Limited to near market end of innovation chain ▪ Tends to be specific successful actors
Industry Associations	Medium	Consultations on policy:

		▪ Tend to take 'lowest common denominator' approach ▪ Some exceptions, e.g. APGTF
Academics	Medium	▪ Called in for specialist advice ▪ Lobbying o Tendency to seek funding as priority o Need for more co-ordinated strategic approach ▪ Policy academics and Technology specialists
Citizens	Low	Indirect influence through policy makers needing votes ▪ Diversity of views ▪ Sometimes direct action ▪ Sometimes protest ▪ Early adopters of technology
Supermarkets & Retailers	Low	
Builders	Low	
Financiers	Low	

4.2b How can those stakeholders insufficiently engaged in innovation policy be brought into its development more effectively?

Group A

What are the reasons for including these stakeholders?	
Stakeholder	Reasons
Civil society	Certainty / long term goal setting CC Goals / technology / social needs → engaging broader range of civil society
What are the obstacles to greater inclusion?	
Stakeholder	Obstacles
Energy efficiency industry Voters Civil society	Not coherent Too many consultations Time Sense that will be ignored Agency – is this what we should/can do?
Suggest techniques and entry points for including these stakeholders.	
Stakeholder	Techniques or entry points
Civil society Wider civil society	Single point & contact with all consultations listed Deliberate approaches Self-selection versus central management of who engages Low C visionary exercises – draws people in On-line social networking? - means of discussion? – Speed Local level engagement, e.g. transition towns TV, radio, press (+ web site link) – not our job to save planet?

SMEs	RERR help understand opportunities re low C

Group B

Stakeholders insufficiently engaged in innovation policy:	**What are the reasons for including these stakeholders?**	**What are the obstacles to greater inclusion of these stakeholders?**	**Suggest techniques and entry points for including these stakeholders.**
Builders	Obvious, large impact Deliver outcomes	Old thinking Rule takers No perceived benefit	Reward participation Penalise failure to contribute
Planners	Gatekeepers Set boundaries of legitimacy	Non-joined up government Perceived as 'problems' and solutions	Active engagement in debate and policy formation
NGOs	Non-market value Social values Create awareness Opinion leaders	Lack of resource Organizational capacity Ideological, anti-government	Partnerships for their participants Policy maker can visit NGOs
Financiers	Essential to generate investment, and to inform policy frame workers to produce 'bankable' solutions	Not in their commercial interest because high risk / low return area	They have access, but little interest in low carbon area
Local citizens groups, e.g. Transition Towns	Highlight social concerns	Diverse, lack of capacity High transaction costs	Citizens' juries Community forums
Project developers, e.g. CHP, Renewables	They are not the 'sharp end' Understand issues	Self perception as part of innovation process Limited resources for engagement	Consultations – but need active 'information pull'
Industry Associations	Easy to deal with (give government false sense of security) Can provide informed, moderated view (risk of lowest common denominator)	Prior assumption about which are important – some remain 'outsiders'	Draw 'energy innovation' boundary more widely More transparency
Citizens	They are a key part of the solution Source of creative solutions	Apathy Volume and diversity Engagement is	Creative – deliberative processes Social

	Develops additional resources for future through e.g. education	indirect	experimentation More political faith in relevant engagement processes
Supermarkets and retailers	Understand consumer Key part of demand sector CO_2 emissions = £ (products they sell)	Traditionally seen as 'outsiders' Climate change not central to their business model	Consumer pressure Regulation Customer of low carbon technology
Supply Chain: SMEs			
Regional bodies, e.g. RDAs			
Academics			
Supply Chain: Installers			

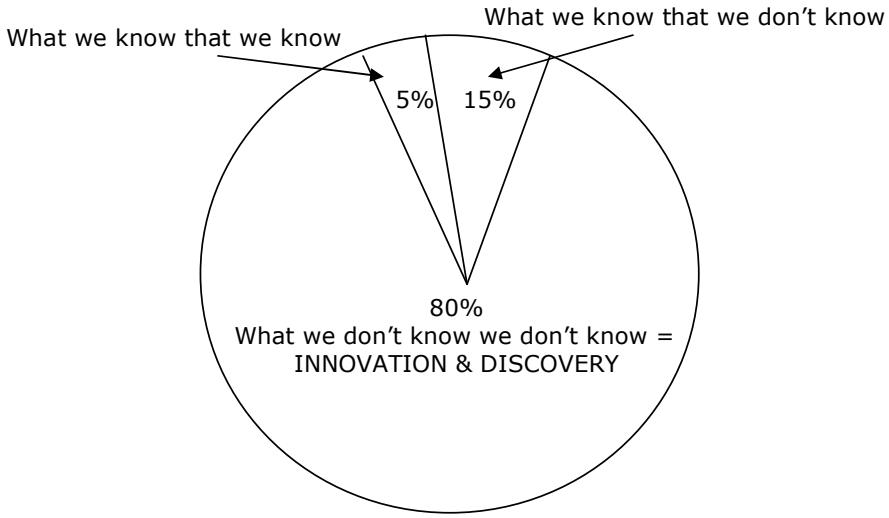
Issue 4 Review

Following the two break-out groups, the larger group reconvened and was asked to discuss the following question: Does the degree of inclusion in the development of innovation policy link to the variety of innovation that gets supported? All points were recorded on flip chart paper.

Discussion

- We don't really know what social innovation looks like or how to support it or which policy would support it – so it tends to get overlooked
  - We don't need more new technology to achieve targets, what we need is social innovation
- Who should be involved, who isn't?
  - Re SMEs – should Carbon Trust etc be asked to understand SMEs or should SMEs be asked to understand carbon – SMEs could be asked to focus on this
- SMEs need guaranteed income streams and they need defined markets in order to be helped and understand where there are markets for their products
  - e.g. Sweden – government acts as glue between market players and guaranteeing a market for what they have to offer – we could do that here
- supply / demand was a topic debated in one of the groups
  innovation policy should be specific about this
- Incumbents should be urged to act more quickly (not everyone agreed with this)
- Should we focus on the institutes and structures of policy to move forward
  - There is still a gap on the innovation side
  - Innovation policy needs to be defined and its structure made more robust
- If you look broadly:
  Electricity supply → heat – demand – this encompasses social as well as technology issues

- The degree of inclusion doesn't necessarily solve the problem and lead to better inclusion
  - Mode of inclusion is what's important
- We need to be mindful of the time we have available to deal with the carbon issue / meet targets
  - We must make whatever policy changes are needed to facilitate this
- We need to unpack what we don't know: innovation (see diagram)
  - The business models we have now will not all deal with climate change – we are not thinking big enough about how we will need to change
  - Business schools need to look at how business models will need to adapt
- The driver for low carbon innovation is social, whereas innovation in the past has been driven by £ making and private benefit



- There is a question about how much we can learn from the past in our current context
- We must align the public and private, however, to go forward

Issue Synthesis Session

This final session sought to summarise lessons derived from previous exercises/discussions across the groups for **each issue**. This carousel exercise synthesises for each issue – it **does not look for any synthesis across the issues.** For the first breakout group participants chose either *Technology priorities and portfolio appraisal* or *Long term signals and adaptable policy.* For the second breakout group, participants chose either *Social innovation and technology fixes* or *Incumbents and outsiders*

Discussion Results: Issue 1: Technology priorities and portfolio appraisal

What recommendations would you make to policy-makers that will address the issue features listed above? Points below listed in order of discussion.

1. It is crucial for various policy instruments to be coordinated towards commonly agreed outcomes, whilst recognising the diversity of solutions available and the need to adapt as markets develop or fail
2. Balanced portfolio across all sectors (demand and supply) and end-uses (industry, transport, commercial buildings, residential, heat and electricity).
3. Diversity in innovation portfolio: define what it is, evaluate current portfolio and adjust
4. Create consensus – through national debate – on aims of portfolio and their ranking order. For example: 1. GHG reduction; 2. Risk minimisation; 3. Societal benefits in UK
5. Explore technologies that contribute across sectors from high-value, low-volume niches to low-value mass markets, eg. Vacuum insulated panels, which can be used for transport, to buildings to appliances. Eg. LED lighting.
6. Need combination of policy instruments that both bring mature technologies to market and bring new technologies to markets
7. Apportion remaining carbon emissions endowment on annual basis – let market decide. Auction to industry (60%), Free to individuals (40%). This would be a revolutionary order of magnitude change.
8. Policy must be bold and unafraid to fail, but, it must manage failure effectively.

These were also generated by group members as recommendations but were not discussed:

- We haven't grasped the scale of the changes needed to both mitigate and adapt to climate change
- Needs co-evolution of technology and business models. We have to do both.
- Focus on technology needs to become focus on business, change management and innovation
- Promoting existing 'proven' technologies to meet short term demand. Demonstrated, low carbon, cost-effective.
  Promoting new technologies for long-term research and development
- System-level tool to address supply/demand side potentially and explicitly span alternate system futures.
- UK position in wider international context (eg. Technology-buyer or technology-developer?)

Discussion points

- Is there a policy window for a portfolio approach?
- A portfolio approach is not a conscious policy choice by the government; the government just happens to be supporting more than one thing;
- A portfolio approach to policy was a Stern recommendation
- There is no differentiation between demand and supply
- Need to consider European Commission and UK contexts regarding portfolio approaches to policy
- Example of fuel cell development: Detailed work done on how to get this technology to the market.
- Another example given of SuperGen and its systematic approach

- A portfolio approach requires appropriate methods and tools at a systems level. Without this, it is not a portfolio approach.

Discussion on Recommendations

- Need to understand what is meant by diversity and then evaluate our current portfolio
- Need an evaluation document from government
- Diversity – do we mean lots of different things, or different in what they do?
- This is happening to some extent; need to know what is missing.
- Consistency issue – how do these things fit together
- Regarding the recommendation on consensus, there was agreement that this was a good point but there are issues around consensus.
- Technology on demand reduction side – we need a strategy to be trialled in high-value, low volume situations. Eg. LED lighting – can be used for vehicle indicators, traffic lights, hotel/retail lighting, residential purposes. Vacuum-insulated panels can be used for transport, refrigeration, among others.
- Be more strategic about technology penetration. Why? Because currently we don't look at innovation across sectors, we look at niches.

Need combination of policy instruments that both bring mature technologies to market and bring new technologies to markets
Discussion:

- Need to be aware of definition of success. For example, need to set constraints for delivery. Strengths – this is necessary, but not sufficient.
- Create technological take up through incentives
- Annual targets are too rigid
- Innovation is not a linear, predictable process.

Failure is okay, as long as we learn from it. Caution, however, that learning also based on what you choose to do in the first place.
Evaluation and risk-taking are appropriate methods to reflect uncertainty, tolerance of failure and diversity

Stage-gate approach. For example, in the marine sector. Not failure of the sector itself, despite lag in deployment. This could be addressed through, for example, the Energy Technologies Institute.

How would policy climate need to change?
A common analysis of portfolios is required: how they play, where they fit on the innovation chain, etc.
Clarity required about the carbon reduction targets – 60%, 80%
It was mentioned that the 2050 target is being reviewed this year and there will be a need for this target to be continually update

Regarding Recommendation:

Necessary Changes
Outcomes – aligning these
Short-term targets in the climate change bill creates a new policy context
Suggested that the CCC could offer perspectives
CCC is planning a series of carbon budgets/targets
Policy solution to reflect urgency
Concern about complexity, as this doesn't lead to action
Lay groundwork, although this has consequences such as lock-in.

Regarding Recommendation
Technology portfolios associated with social innovations required

Ned to pay attention to next generation technology as well as what's happening now.

Recommendations 5&6
Range of instruments needed. There was general agreement that this is important
Is policy climate responsive to this diversity?
Mostly regulatory instruments to date.
Research Councils – still money going to research and development
Shift to pragmatic pluralism
Rollout and deployment of technologies across sectors.

Regarding Recommendation #7:
Some disagreement
Ignores what already exists
Adjustment versus abolishment

Regarding Recommendation #8:
Works for portfolio technologies, but not for policy. Can't have policy portfolios for the same thing
Policy should be designed to effectively manage that not everything will progress. However, this addresses technology failure but not policy failure
Sunset clauses – bad idea? Ensures formal review of policy – need some mechanism to do this review.
Fixed review period

Discussion Results Issue 2: Long term signals and adaptable policy

Key policy priorities

- Dynamic, long-term standards for carbon emissions reductions by sector, reviewed and updated at periodic intervals
- Stability in long term goals which could be reviewed periodically in a transparent manner – climate change bill/committee Royal Commission EP 60%
- Grand-fathering investment and explicit review periods can protect confidence and allow flexibility
- Learning and review: need institutional capability to monitor development paths, including markets. eg. OFSTED
- A policy on policy learning: 'failure' can be instructive; transparency, process for acting on lessons, problem framing
- For longer term and more potentially radical innovation, emphasise 'non-UK' processes – international and local; Beyond Westminster
- Policy certainty on outcomes; flexibility on means
- Policy problem re-framing
- Enable local low carbon initiatives by relaxing institutional rules, eg. Restrictions on local government procurement policies;
- Need certainty of long term goals and who will be obliged to deliver
- Design policy to allow flexibility in implementation
- Be bold. Conventional prescriptions may not match the scale of the challenge. Major infrastructure change
- A 'mission' long term policy and forcing adaptation. Eg. Rebuild Sutton Coldfield – generate policy learning.

- Emphasise diffusion of existing good practice (socially and technically) in order to ensure early momentum in delivery of carbon reduction (eg. 'obligations')
- Recognise mitigating priority of climate change as a social objective, with market mechanisms as means.

Policy Review
Requires culture changes in policy – fear of failure and evaluation
Lots of evaluation on international stage. For example, energy efficiency studies in US, IEA evaluations
Transitions literature – how much learning? How do we assess this, though?!
Processes triggered by policy as well as policy goals

Institutional aspect of policy evaluation
Need institutional fix
Individual departments/office of climate change, /parliament
Should be in between
Urban sanitation required local government creation

Policy Priority Recommendations:
- Learning – what do we mean? Think long-term stability with flexibility
- Emphasise need to combine longer term stability with flexibility
- Reconciling tension = of policy design and process
- Learning as part of global effort – even for UK who leads on climate change!
- Emphasis on CAP = excuse for inaction
- CCS best at EU level
- Raise profile of IEA? – not as suitable as EU for technology policy
- Targets for modal shifts – DET

Other Points
- Don't hide behind organisational re-organisation
- Climate change committee (CCC) good – make effective
- Embed understanding of innovation in the CCC. i.e. Not just marginal cost abatement – need dynamic framework.
- Then cascade to departments and embed carbon in policies
- Highlight issue that doesn't equal new technologies but diffusion of general good practice, for example around local authorities
- Need to deliver genuine carbon reductions soon via diffusion
- Align diverse policy arenas – reduce carbon objectives/policies eg. Aviation, planning
- Prevent movement in opposite directions
- Departmental re-organisation around carbon – but not necessarily feasible as would have to involve all departments.
- Re-frame problem – integrate innovation into CBA or an alternative see CEMEP (Commission on Environmental markets and economic performance)

Discussion Results Issue 3: Social innovation and technology fixes

Assumption: Social entrepreneurship versus non-profit innovations.
Should we be looking at transformation of business models for low carbon innovation?

Definition of social innovation to include social dimension of innovation

eg. Personal mobility – car firm with lease model, community bike plan. The policy drivers for these innovations are different.

Social entrepreneur drivers are not local.
Local initiatives remain isolated. Need national framework to assist with diffusion.

Non-Commercial
Principal driver is not rent-seeking. Therefore, innovation needs to be understood differently

Recommendation:
Do research on drivers
Eg. Stakeholder workshops

Social, personal goal – what is the policy aspect of this?

Policy norm means reducing carbon use
Social Community norm
Personal/lifestyle aspirations

Need to align all three of these

Funding – one type of 'prize' model
People already want to do this, policy needed to support this.

Community aspect – not looked at from an innovation perspective, or people as innovators.

Peer to peer: sharing with others
Open innovation (such as open source software)

Personal lifestyle aspiration leading to social entrepreneurship

Need learning between models
Suggestion: New Economics Foundation connecting with communities
Successes, such as Woking and Aberdeen

Commercial
Government supports low carbon innovators and entrepreneurs and encourages market testing and user learning

- Car clubs
- ESCOs (Energy Service Companies)
- Concierge services for home refurbishment

28 Day rule

Regulatory context more favourable to a particular business model
These three share issues such as personal lifestyle and aspirations. For example, brand loyalty.

Entrepreneurial model is replicable

Needs to secure finance, persuasive business case, understanding of market

Carbon Trust Venture Fund – conservative. Doesn't support social innovations

Need a venture fund focussed on social innovations. Could modify the remit of the Carbon Trust to include this.

Venture funds invest in intellectual property

Eg. Car phone warehouse – branded
Sell aspirations/values
How can policy help this process?

Policy Makers need to seek out and listen to low carbon entrepreneurs

Lower Carbon Business parks – free office space

Low carbon champions/role models
Case studies, awards, mentoring (eg. Dragon's den)

Local enterprise authorities – more attention to low carbon innovation

- Reconceptualisation of innovation policy required
- Role of SME support or existing low carbon innovation (SME policy is not innovation policy)
- No actual entrepreneurial policy on a national level.

The above examples are policy orphans. This is something for NESTA or the Carbon Trust to tackle – not a role for DBERR (Department for Business, Enterprise and Regulatory Reform).

Discussion results: Issue 3:

- Embed 'low carbon' in the objectives of local/regional government and agencies
- Local strategic partnership to support SMEs deploying low carbon technologies
- Re-orient SME policy to low carbon focus
- Must learn non-European language as part of any science degree at graduate or postgraduate level
- Limits to competitions (eg. NESTA £1million
- Can lead to de-motivation among 'losers'
- If something works, give it more support. Eg. NESTA, ETI, start small and build
- Educate boards of foundations
- 'top down' social innovations
- Assess, learn and diffuse
- Eg. From bus lanes, long-charge, obligatory car sharing
- Parking policies
- Government to facilitate development of energy service companies

Plenary discussion Issue 3: Social Innovation

- Support empower and network 'social innovation' champions and pioneers.
- Support a long term programme of 'low carbon social entrepreneurs'
- More resources for bottom-up initiatives: eg. Transition town network
- 'Nobel' type prize for socially innovative experts
- Link up social and technology innovation 'pioneers' or champions
- Registered social entrepreneur companies exempt from VAT
- Public funding support for 'transition towns' groups

- High-profile competition to find low carbon social innovations with a low carbon prize
- Funding route? Certification model?
- Keep funding calls open and stable
- Lottery money?
- Millennium commission?
- Need link to certification (happens a little already, eg. Local authority insultation)
- Lottery has been good. Therefore sense of social responsibility

- Often barriers eg. Council risk assessment. Needs more support than barriers. Support from bottom-up. Eg. Air/Rail Workers and change in social behaviour at time

- Policy needs to facilitate a period of experimentation and then evaluate – raft of attempts to decrease carbon in households.

- Conflict between citizen engagement and ESCOs models? One is contracting out, other then opposite.

- Single price – many ideas lost
- Need more money in smaller chunks that are easier to get

- Assimilate best practice
- What works best together
- What level of institutions best at delivery

- Danish 100% renewable (island Samsu?) Prize from government drove it. Shown can be done – teaching academy

- Need real life experiments
- Role for maverick champion eg. Richmond 4x4
- Distinguish between imposed and voluntary. Eg. Congestion charge unpopular among some
- EEC incentives for ESCOs unsuccessful
- Microgen – increased capitalisation on consumer site.
- Research different models for encouraging energy efficiency

Whose responsibility:
DEFRA?
DFT?

Who most appropriate to find community based initiatives?
Countryside agency
EST to deliver

Where are social innovations coming from?
Need more than 1 prize (NESTA model)
Very different from market based regulatory solutions

Comment [FK3]: Does all of this need to go into the next section???

Plenary discussion on key workshop issues to take forward

The following question was posed to the group and all points were recorded on flipchart paper as noted in the text below.

What are your key issues to take forward?

1. The social entrepreneurs: what alternative business models could support this and how could government help.
2. It's not just a technology issue – its getting the technology into the marketplace and business models are needed to address that.
3. We need to avoid a technology versus behaviour change flavour. We need to focus on both.
4. The meta issues and the holistic picture is most important and it's not appropriate to isolate one issue such as entrepreneurship
5. What is low carbon innovation policy? This is a key question – it's borders are porous and each covers many things including:
   - SME support
   - Housing policy
   - Transport policy, etc.
6. You cannot banner everything as low carbon innovation but you need to include social innovation.
7. The last session raised many useful points – it's going to be a challenge to keep the profile of this area raised
8. Innovation policy can focus on national and economic benefits
9. The four issues discussed have been useful but need bringing together/synthesis.
10. Policy briefing: we need to talk about definition, etc. – but we can integrate points that have been taken at this workshop
11. Keep policy focussed on outcomes but keep means open – do not prescribe as it cuts off possibilities when innovating.

Closing Remarks

Professor Gordon MacKerron, Director of the Sussex Energy Group

- Boundaries: We must be neither too narrow or broad in moving forward
- Impressed with how wide ranging the discussions have been
- Please come back to us and let us know what is needed to follow up
- Much has been opened up but not much closed down – a half day workshop is a possibility and there has been some interest in this.
- Together with UKERC, we will prepare a report of this meeting and continue to work on a policy brief to be launched in the spring of this year.
- Thank you for making this a very stimulating workshop.

Appendix 1: Issue 1 Discussion

Red Group

- Stage and timing
- All three "legs" of sustainability to be embodied
- Sustainability trade offs
- Vs. Carbon reduction impact, contribution to emissions reductions
- Timing – within innovation "chain" stage of development R& E – cost down

Yellow Group

- Managing future risk
- Biofuel e.g: broader consequences
- Unintended outcomes from not being tech specific
- Rationale – proven C savings
- Risk of not being tech specific is that we are often ending up being tech specific
- Rationale scarce resources, e.g. support

Rationale:

- Develop new business(es) (industrial policy goal), e.g. nuclear, marine/ microgen (these are generic)
- Helping existing business
- Political expediency, e.g. regional support
- (Health warning)
- Microgen is a 'class' not a technology – be specific and clear what you mean
- So when defining a policy, avoid term microgen? Focus on distributed generation instead? e.g. up to 100 mw

Key rationales

- In reality, a 'level' playing field requires differentiated support
- All must be winners, just on different timescales
- Tech scheme specifically
- That seems to be the world we're living in
- Resources are constrained – it's not like foot and mouth
- Risk: Government has sometimes picked losers in the past – why should government be good now?
- Disadvantages of tech specific:
- Choices are made not transparently / explicitly

- System-level trade-offs should be made explicitly
- Predictions of the final outcome of innovation may be wrong
- This <u>is</u> an emergency
- Events are running away with us
- We will need <u>all</u> Low Carbon Tech so devise bespoke policies suited to the needs of each
- Rationale: generic approaches often fail to bring forward technologies fast enough

- Case study based literature suggests - sensible to be technology specific
- Supported by tech studies approach
- Balancing points:
  - How can you government know? → dangerous
  - Existing infrastructure / lock-in implies inherent advantage
  - Allow for unexpected
- Recognise events are running away
- Will need <u>all</u> low carbon technology
- Need bespoke measures suited to stage of development
- Not what will win / loose, but how quickly – urgency, e.g. foot & mouth decisions too slow; events can run away

- Development of new industries that include significant competitive advantage for UK based firms
- Balancing UK competition against shared 'Learning Investment' across many countries to get speed
- (For a UK focus) Does it work well in the UK context? (e.g. demand, geology, etc)
- Can it make big cuts in emissions at an acceptable

overall cost? And by the time we need them?
- Balancing overall cost (social cost, life cycle costs, technology learning) with overall risk (technology risk, resilience, business risk etc)
- Cheapest way of reducing carbon emissions associated with UK energy supply
- Lifetime basis
- Minimisation of (potential) overall costs – 'private' costs now / lifecycle / social
- Scope for rapid reductions in carbon emissions in the next 15 years
- Bear in mind life cycle of existing generation, distribution and use
- Must end up with technology mix which matches future resources and demands and not be bounded by current budgets
- To reduce cumulative emissions technically mature technologies must be implemented on a mass scale immediately
- Government – for long-term potential, where private sector is unable to 'maintain the option'
- Does it complement / hedge (i.e. not duplicate) other technologies that are being supported?
- At the portfolio / system perspective – to exploit 'synergies' by combining diverse ways of supplying energy – different supply profiles of different technologies

- Right balance for seasonal demand
- Change energy demand
- Displace Carbon intensive sectors → Carbon free or low Carbon
- Substitute existing ways of generating energy
- Aggregate system-level approach to assessing the problem
- Time-line important
- Take forward view, differentiate into future 230, 2050 etc
- Strategic policy plan for Europe, 2010 priorities for 2020, 2050; what can be done to prepare the government
- Scale – can it be scaled up in terms of overall emissions
- What kind of substitutions?
- Time-line for existing hardware
  But can government have this view? Often wrong
- Stock turnover across the board
- But be aware of interaction with end-use tech
- Job creation
  Overcomes lack of competitiveness complaints
- Minimise overall cost (social costs, life-cycle, tech learning implications)
- Bear in mind interactions between costs and cumulative deployment
- Unforeseen costs / impacts
- What is UK resource endowment?
- Minimise overall risk
  - Tech risk
  - Reliability
  - Portfolio risk
- Security dimensions
  - Technically mature technologies need to get to market
  - Addition to resilience of system
  - What do we mean by 'security'? Foreign versus domestic – which more important? e.g fuel protests
- Complementarities
  - Short-term
  - Long-term
  - Mature / future
- Interactions between options – be aware of – institutionally, resources, regulations; sometimes unforeseen
- Risk
  Ok for things to fail → learning
- Diversity
  - What kind of diversity
  - Disparity
  - Balance
- Security
  - System level
  - Resilience – including adaptation
- Urgency
  - Need to be revolutionary versus incremental, e.g. zero C for new housing by 2016
  - Order of magnitude issue
  - Change of business model scale, e.g. ESCOs

- Comparison with telecoms – service package
- Government – grounds man or referee?
- Need every technology we have
  But everything has different niche / selection criteria
  Does this apply equally on supply side? Yes/no?
  → Risk
- e.g resources for nuclear versus other low C or big plants versus many small
- will regulatory structure change / be challenged?
- Regulatory and business structure needs to change over timescales involved → e.g. nuclear will company take liability over 1000s years
- Markets need to be made C aware / driven

Green Group

Potential UK carbon reduction

- Size of UK and international
  - Carbon reduction potential
  - Economic benefit to the UK
  - Cost effectiveness of carbon saving – Market failure
  - Potential for deployment in India, China
  - (Balance demand side with supply side)
  - Support UK leadership role
- Support UK leadership role
- Capacity collaborate internationally (public and private)
- Market failure
- Economic benefits of UK
- Potential for Development in India and China
- Social acceptability
- Political consensus e.g. nuclear? Other technologies?
- Potential commercial application by 2020 Implication stress diffusion of existing, technically proven technology.
- Knowledge capacity
- Implantation opportunity - May be in UK capacity but implemented somewhere else e.g. Wind
- Also a sum game, - not every country can be involved in all issues.
- Good idea in place versus getting through chain, good ideas don't always work
- Cost effectiveness of carbon saving.
- Urgency criteria
- Willingness to take risks
- Generic consensus vs. NIMBY
- Funding – flips criteria we can use …..may not be most NB criteria selected. + time limits +added value
  - Distributed /centralised input network technologies – therefore need flexibility
  - Portfolio
  - Need complementary technologies – network management. Demand Side Management - balancing supply side versus demand side
  - Networking structure complementary technologies (networks, DSM)
  - Responsiveness as markets develop (flexibility
  - Which areas of the economy does government have the most influence/control over
  - Complexity – portfolio approach needed
  - Balancing supply and demand side
  - Enabling – need some technologies as they are required to do the rest. – a practical and political issue
  - Goult – difficulty with emerging entrepreneurs

Note: Criteria approach questionable
Deeper question
Environmental Transformation Fund uses "principles"
Values – looking at Research Councils– (more investment more responsive to a set of criteria, rather that solely peer – review process
Diversity vs. duplication – tension here

Note chaos leads to innovation – part of the debate

- Supply side vs. demand side
- Boundaries
- Traditionally budget issue, but also political

- Supply and demand – both require social decisions
- E.g. Network w/higher proportion of renewables and micro generation metering, communication, products decisions about transmission

Demand side e.g. internet – French took initiative 5 years and the www emerged
Problem of lock–in

Are there additional criteria which should be applied at the level of portfolios?

1. should governments set priorities?
2. does the portfolio address the full scope of UK carbon emission (e.g. transport, heating, electricity, demand reduction low carbon supply)
3. what kind of diversity should be sought? In Fuels? Types of technologies ? In risk profile?

+ C.T. Uses criteria

Limited funding
Arguably driving niche technologies.

Technology specific
Strengths

- Play to resources, or what's in place in your country
- Building national capacities
- Does drive innovation
- Effective prioritisation

Policies
Weaknesses

- Tension between engineering and social uptake
- Lock-in
- Problem that you may not have the desired impact
- Unintended consequences
- Politically – special interests/lobbying effort
- To focus narrowly on energy technology specific policies doesn't tell you much
- Rebound effect and increased wealth tends to increase energy consumption

Blue Group

Rationales and weaknesses of tech-specific policy

- Time and phases of change – do we know enough to make these kind of commitments → pilots are important
- Targets – e.g. zero C for homes – these are not always feasible – but it does work to engage key players, .eg. house builders in low C initiatives- and make some headway
  - a balance needs to be struck
  - Some headway can be made – even if end goal is not reached so still can be beneficial
  - There can be a rationale for specifying technologies but setting % target frames for people to aim for need to be carefully done
    e.g. if you set a target for 2020 and some technologies, e.g. tidal power cannot complete until 2025, then you exclude them
  - Transparency is needed as to why particular targets have been set
  - e.g. need to say what zero energy <u>is</u> – what is the definition – not just say 'zero carbon'
- Different types of energy technology may need differentiated targets – they need to be made specifically realistic per type of technology
- Need to include: obligations, targeted R&D support, regulations – no reason to assume market will always deliver
- Lack of monitoring of regulations, e.g. condensing boiler regulations – have not been monitored
- Could invest in a service, e.g. Green Concierge, rather than a technology – this is more easily updated and can provide a learning base
- Ok to pick business but need to create a means to reduce uncertainty first and see interconnections between systems

1) Can we lead the field sufficiently – to have the potential to create an industry
2) Security not just about supply, but considering the consequences of going heavily into a particular technology – don't lock into a particular technology
3) Related issue – if there is likely to be a need to update the technology, e.g. wind turbines
   - How much 'turnover' is there of technology development
   - Reliability is a related issue
4) If it is, e.g. natural gas as tech choice – you need to consider source of this fuel – can it be accessed with total long term certainty
   - Policy has to be consistent with all other policy goals
5) Need to consider factors such as fuel poverty - is the technology going to be accessible to all?
6) Need to look at more than carbon – but other wider environmental impacts (including outside UK), e.g. deforestation, loss of biodiversity, greenhouse gases, life-cycle, sustainability / efficiency
   - Should take account of this
7) Might be fossil fuel efficient, but not necessarily have a long role in low carbon future
   - E.g. natural gas, CHP
   - Need to consider need for consistency of a centralised or de-centralised energy approach
8) Need to consider need for speed – how quickly can the low carbon tech option come into effect
9) Risk profile – scale of effects of accidents
10) Long term cost implications – should be cost effective in the long term –shouldn't waste resources
   - There may also be disposal or recycling costs to account for
   - How you put costs together needs to be considered – complex area to cover
11) Infrastructure – if technology can take advantage of existing infrastructure, it could come on stream quicker
   - However, need to temper this – the infrastructure may be wrong and need changing

Criteria to select the right portfolio of technologies

- Electricity, transport, supply would need to be covered by the portfolio
  If we are to achieve low carbon aims
- Risk profile of portfolio as a whole – need to have blend of low and higher risk technologies, e.g. some may work well, others may not achieve full development
- What is the ideal portfolio for society? – it would want to support range with most societal benefit
  - this will be different from ideal of businesses
  - The portfolio needs to include tech that can bring together ones that will come on stream at different times, avoid gaps / waits
- Are local resilience needs met as well as national scale needs; does it allow both
  - This relates to security of supply
- Market leading portfolios!
  - Better to specialise in a particular type of tech
  - Need to consider tension between this and risk, security of supply
- Need to have the right degree of fit between the techs in the portfolio – need to be mutually supporting, e.g. high level of renewables needs storage technologies to go with it
  - NB you can support a range of technologies – they may not fit together well, but would increase opportunity to have a 'winner '
  - 2 techs combined may create a much better product – more cost effective to produce and easier to use, e.g. hydrogen, transport, storage, waste gasification may take advantage of each others mutual benefits

e.g. microgeneration needs smart meters

- A technology plus a market or service innovation may be another way to use combinations to gain benefit (e.g. local nappy laundry – a social innovation - a product service system
- Diversity – relates to earlier phases of change – you need more options to begin with
  - Does not require differentiation across all the characteristics of the technologies
  - Concept of improving the old while experimenting with the new.

Appendix 2: Issue 2 Discussion

Identify the advantages and disadvantages of certainty or flexibility in low carbon energy innovation policy.

Certainty

Yellow group

Too much certainty not necessarily good
- need to stick to stated goals/outcomes desired
- separate ends (certain) and means (subject flexing)

e.g new build – easy if transport biomass OK if not then need flexibility
e.g carbon intensity of electricity generation - valid for electric companies to say can't do it so how respond?
- need clear penalty structure for non compliance, meaningful in context of business e.g. no building consent
- zero emission vehicles – companies took government to court
  - more R&D but necessary desired outcome, principal right, but hard to achieve
- difference between setting aim and target
- no zero carbon homes by 2016 – not target wrong, just means failed to meet it.

- Diff between zero C homes (easier) and vehicles (harder)
- Value of targets relative to incentives e.g. CHP vs.
  need reason to do things diff.
- Standard vs. targets (homes)
- History – how response developed
- Got to get it right if aiming for certainty in policy
- Coping with political inertia
- Imp for diff. reasons relative to acta in system
  e.g. CTrust investor perspectives work certainty requi in past (before privatisation) imp for continuity of investment
- can't be certain of electricity price so why should you be re: carbon price
- certainty of funding important for investors
- Research and Development accepts failure (1 in 10)
- But small business under pressure to deliver business model that can be sold on
- Do political actors need certainty?
  don't have to live with consequences of targets/limitation
  - Accountability to targets ; imp. E.g. CC bill – sanctions?
- Climate Change Bill budgeting process may transcend party e.g. pensions reui.
  Party agreement re. budgeting process in future
- Political actors create certainty
  - do they meet framework to take decisions
  - ability to set long-term targets without other parties reieculing
  - cross party agreement
- Policies
- PRO
  - Fines re-distributed
  - But well behind where should be
  - Penalty not high enough?
  - Other weakness in system e.g. planning?

- Too much risk?

- RO vs feed –in
- reverse P. certain Outcome uncertain

Too soon to know long-term outcome?

- evaluation policy
  - – frameworks need to feed back into policy and review
  - Eval should be in public realm. Public money

- Is this about flexibility?
- If we say will review will it undermine?
  - How make flex more certain?
  - Make desired outcomes more certain
- Uncertainty – discounting in decisions
- Need to be clear that review – more certainty
  - CAN'T discount
- Grandfathering – protection from results of policy reviews e.g. no 5 yr. cut-off
- NFFO – transitional arrangement to avoid unexpected risks

- e.g. of certainty EU cars – if had teeth with time-line for successive (arrow down) and meaningful penalties
- incremental steps might discourage radical innovation
- fleet average approach would allow for radical moves
- lgC over target – 1% of turnover into car clubs – more creative fines
- Do we need car –like standards for e.g. power stations?
- Supplier obligation does it further down the line
- Social advantage to certainty e.g. regarding message change (not enough impact)
  look at diff wedges link transport certainty to food to energy
  but even g per Km uncertain – how many km being driven?
- Targets need to be nested
- Can only achieve if C budgets connected to levers
- Why don't budgets tie into spending cycles?
- UK /intl. tension (KYOTO/vs UK spending review)
- Not clear that C-budgets won't be links to levers
  depends on committee
- Impact of RO
  - Higher/rising risk
  - Or – renewables key investment consideration?
  - But gas still central investment re. capacity
  - Has it closed the gab enough to go fast enough
  - Not just RO – grid consent , planning etc.
  - E.g. where (Siemens)???? saw project as too small re. fulfilling obligations (local Oxfordshire app. for 6 turbines)

Green group

1. Long-term investments in capital intensive assets
   a. Q. is this true in shorter term?
   should we distinguish "points"?
   along the innovation process
   b. dependent on who will fund

c. UK important
d. Certainty that CO2 an issue

Are we talking about certainty of targets?
Industry needs certainty in the market – that moving towards 60% reduction?

Certainty of 60% not solely domestic – credits other mechanisms

- A sign of the future(60%), therefore a business decision of how to respond
- EU legislation bind UK in a way UK domestic policy can't.
- E.g. variation in oil price – even if you have carbon target certainty
- For business the low carbon techs not the driver as they are more expensive
- Can't bind government to specific set of solutions

- Business making investment decisions based no low carbon policy
- Certainty in terms of pricing
- Certainty in terms of regulatory
- Regulation/legislation – not innovation policy per se
- E.g emission standards of cars – an innovation policy
- Very much about tech. innovation
- E.g. that work – e.g Shell, - cars less that 35mpg should not be allowed
- E.g. when not so far from market/deployment, certainty beneficial
- More innovation versus deployment
- Businesses take %60 target seriously and decisions made on this in R&D

- Business decisions debate greatly reduced re. carbon reduction

Drawbacks

- Can't have too much certainty
- Putting all your eggs in one basket
- Unexpected consequences – how do you respond to this
- Inadequacy of foresight by government regarding unintended consequences e.g. windfall gains and credibility
- May change climate for future investment
- Opportunity cost and lock-in
- Carbon budget idea trying to overcome this
- Carbon budget doesn't say anything about energy policy

- Investment sector
- Also important for policy makers as they can't always make decisions in real-time
- Industry

Why long-term advantageous?
Overestimate short-term, underestimate long-term
Weighting in favour of business

Technology specificity is long-term and much less certain/stable

Examples

- Co firing – not enough stability
- ETS – emission trading system
- Renewables obligation
- General emissions legislation at UK or EU level
- Vehicle standards

Comments/Observations

- ETS in terms of certainty
- Carbon pricing identified by both groups

Issue 2
Q1
Combining adv. of certainty and flexibility

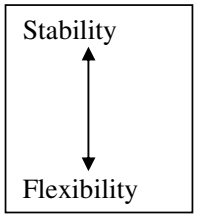
- Certainty for long-term , with short-term flexibility – good if you can deliver , whether credible /questionable
- Political effort to have consensus across party lines – intended to bring stability

Flexibility

Blue Group

- Point re: over-committing – if one technology doesn't deliver and you have bet on specific ones a problem – you need to have an adaptive portfolio as time goes by – an adaptive mechanism for delivery.
- You need to establish the time frame involved: 5 years, 50 years
- Goals: need more limits to flexibility with respect to goals

Hierarchy of flexibility:



- Worldview
- Goals
- Policies
- Technologies

Depends on for whom

- The producer/investor/policy makers/regulators/user have different roles and thus different needs. eg. Investor prefers stability
- Need to consider the investment made by user eg. Householders have expectation that a boiler for the home might last 12 years.

There are two kinds of innovators – one may be established, one radical, the latter would benefit from greater flexibility.

What sort of flexibility is needed for different stakeholders?

a) Policy makers need diversity – if some technologies go wrong the policy still works. Not quite the same for the developer, though, if the technology fails…

b) Drawbacks?

- Are you investing in people, knowledge creation or the products?
- If policy is too flexible, a change of government/political change may bring policy change – this could lead to lack of confidence on the part of investors.

- The government could specifically I.D. areas within policy that are either flexible or stable, as appropriate.

  eg. There may be some marginal technological areas (such as insulation) where flexibility is fine, but other technologies require very long term commitment. eg. fuel cell

- Direct current grid allowing district and regional generation – an example of a mix of stable policy with flexibility

- You won't get systemic change with too much flexibility – refer to hierarchy of flexibility

- Which technology gets brought forward: those that are likely to be affected by changes in the policy framework are likely to be disadvantaged
- eg. Nuclear would suffer more than wind technology

- What about our expectations of politicians – can we trust their consistency – can we change their behaviour

c)

- Establishing a carbon price – its specific on the challenge and open on the solution.

- What about pilots and exemplary projects – these provide more information.
- More flexibility through a 10/20 year research programme

- Banded obligations policy – enables technologies to move out as they become more mature

- Tariffs retained for a period of time with flexibility to alter rate after this point

- Update technology standards over time. eg. Japanese top runner system.

- What about guidelines for research bodies and research funding policy. eg. Joint university research partnerships

- Rolling budgets eg. Climate change bill – an advantage? – retaining goal stability but immediate goals are flexible.

- Depends what policy instruments are there to help goals to be met

- Flexible framework rather than flexible innovation policy

Developing policy mixes that combine flexibility and certainty

Blue/Green

- Took time for policy to respond to Kyoto emission reduction commitments
- Banded renewables obligation diff band – can offer diff level of supports depending on the technology. Framework = certainty but w/flexibility w/in certain criteria
- Taken a long time to get this certainty .A learning cycle to get this right
  And still don't know!!!

- Climate change targets – heading towards certain, binding targets. This is new
  - climate vs. innovation policy
  ----- have these merged?
- Stick to broad definition of innovation
  - new to UK, localities, sectors

Classic solution of broad framework with technology neutrality have we moved from this?

- Where do tech-specific priorities fit in?
- Business also asking for continued support in fundamental R&D funding and scale of funding (w/in broader framework)
  in demo and deployment
- How to do this w/out picking winners
- With concrete short-term policy (e.g. 10%wind), why do you need a long –term signal
- Responsibility. Industry against this. Unless additional support provided
- Creating "a selection environment" A process that requires marketing

Opening and closing rhythm – re framework and technology-specific policies

Examples – Getting it right

- **Bio-ethanol Prod" / in Brazil**
  - **Short term measures encouraged to overcome barriers**
  - **Broad aim framework**
    Long-term desire to change fuel consumption mode
- **Car technologies, % age of bio-ethanol require months. And other policy initiatives**
- **Was this a "lucky strike" – all eggs in one basket (based on oil prices)**
- **Can we necessarily take policy lessons from this**
- **Direct legislation /regulatory processes**
- **Systemic change requires standards/regulations**

Introduction of natural gas into Britain – very regulatory approach
Liberalised markets lead to change

Fuel efficiency standards

- Introduced incremental measures
- Announced standards in advance

e.g. Japanese – changing appliance standards
e.g. India – wind industry
Components to be indicyenised within 2 years
New industrial innovations within India mechanical flexibility but policy stability

Examples of not working

- e.g. European vehicle standards – lack of clarity and certainty
- e.g. R.O. has not worked completely, remains to be seen
- e.g. EEC - have not stimulated innovation
  - this needs to be incentivised
- e.g. Low carbon vehicle – no change in the demand side (evidence for the contrary)
  - A supply side policy that hasn't been translated, demand
- Car labelling scheme – unknown if this is driving change
- Oil prices likely /perceived to stay high which would drive demand for energy efficient vehicles

Supporting a diversity of designs in Denmark (wind) as opposed to one design (Netherlands)
Denmark – producer co-operatives, by passing resistance

Observations

- Not a lot of specific low carbon innovation policies
- Need to think of range of policies and how they could be thought of in context of innovation policy
- Market Transformation programme
  - contradiction in policy of appliance emissions versus household total emissions

Red/Yellow

EEC/CERT / supplier obligation

- long term targets – overall framework plus flexibility on exactly how to get there.
- Focus on long –term target first not the mechanisms
- Set fixed review dates
- Programme targets set around outcomes – good programme. Set up around spending £ x – bad
  don't be technology specific

- wrong incentive frameworks e.g. low carbon buildings biomass – DTI- 3yr budget but Solar energy no idea of where going at end – drives people away
- EEC / Cert fixed review date
- Funded by levy on consumers – not from treasury (but is from tax)
  - Lesser ??? re working in long-term framework?
  - One legislative base vs. one expendable 1 yr planning horizon vs. longer commitment outside spending review confines.
- What Flex for someone not flex for others?

  - eg feed-in support in Germany consumer rather than taxes
  - but transparency issue – companies claim they spent money
  - 10 yr horizon could lock –in if unsuccessful
  - Outcomes vs. tech choices /cash based targets
  - But 10 year spending programme in e.g. marine is unlikely
  - Don't be technology specific
  - Market mechanisms for marine – (industry lobbied for) to introduce but when introduced no technology ready to use so never drawn on
    - some obligations don't work for early stage technologies
  - If kept generic then could be awarded especially when technology competes

- Ofgem /Defra partnership to run EEC = good
- Better programme design if fewer people and concentration of expertise in same place – learning.
- Flexibility doesn't necessarily lead to adaptability?
- Need new ways of getting consensus and fixing policy quickly
- Industry more powerful than govt lacks spine to implement clear targets and review e.g. voluntary agreements.

- scope /application of policy vs. flexibility over time
- DFC levels e.g. C target across economy vs. standard on vehicles but don't know how people will respond re. driving
- Nesting of targets
  - CS endorsement
  - Proportion diff sections of society
  - Nest down stream

- e.g. concrete boiler vs. other parts of economy

Bad scheme – EU ETS – some certainty
Short phases so flexible but not long enough for certainty and investment

Certainty re. caps but only for each phase
How improve? Tighten up – longer periods but tighter caps

Deliberate (lack of) continuity
Adaptability =/ flexibility? uncertainty

Appendix 3: Issue 3 Discussion

3.1 How can innovation policy attend to the social dimensions of the innovation process?

Group A

- Fashion etc, celebrity endorsement
- Creates consumer demand
- Uptake of technologies is always not economically rational
- Technology may be used in unforeseen ways
- Tell society the truth about how serious a fix we're in – climate and energy security

Empower, support and network our community technology innovators and champions

Group B

- Behaviour aspects of employment
- People willing to use the technologies. In the retail aspects and on demand side (efficiency improvements
- People need to switch off the lights
- Large scale techs. Supplying the energy tech sector – issue is around the acceptability of particular solutions – e.g. wind is renewable but can be unsightly and cause perceived bird issues
- 2 sides to this – one is the acceptability (readying the consumer)
- The best technology solution won't go ahead without public acceptability, support
- We know that learning mechanisms (technology innovation as a social process) are able to foster technological innovation (has already been adopted by govt)
- Albeit in a superficial way e.g. carbon trust has allowed collaboration – but these mechanisms are difficult to get right
- Carbon Trust has had limited budget – this has led to limited criteria on what it will fund and cramped innovation - (arrow) Carbon Trust has probably funded some social innovation
- Maintenance networks, insurance
- Assuming people that support service will be in place if things go wrong
- Standards and testing are also important in this regard
- People need confidence that new technologies will be supported in the longer term
- What can innovation policy makers do to ensure these things arrive at the right moment?
- What business models are relevant?
    - Internet has forged way to new ways of promotion – but has not always been successful
    - We need to make a clever way of doing something that's attractive
- What about tools e.g. ESRC for business :
    - Understanding public acceptability
    - Understanding these social skills
    - Having access to skilled people
- Energy knowledge is much more fragmented than it used to be – there's a need to draw on /tap into this – there's a need to collaborate as well as compete e.g. UKERC, SuperGen projects
- BERR building an experience of clear skies to develop standards and accreditation for microgen products and installers.

Momentum: the industry is slow to change – a re-think about how it is organised may be needed.

Appendix 4 – Issue 4 Discussion

4.1 How can policy-makers support a broader variety of incumbent and outsider innovators?

Group A:

- Bioregional properties
  - Influence Housing Minister re relative cost of eco-houses
- Eco-home design
- Z-homes
- Contracting out eco aspects
  - e.g. ESCO = contrast with doing themselves
  - ESCO vs. housing design co.
- Assume incumbents engaged but housing does not – so how do you engage?
- What is scope of C policy?
  - Only energy?
  - Housing part of energy sector?
- Energy S in household sector
  6 suppliers versus more diversity in commercial / industrial market
  Driven by reg. for consumer protection
  Need marketing presence in domestic sector
  But what about existence of others? e.g. Good Energy
  Euro e.g. large generators, many suppliers
- SME
- Incumbent energy companies link; SMEs? working with British Gas and utilities, e.g. EDF
- BioRegional Quintain partnership successful
  What policy can force co-operation
- Incumbents risk averseness
- Try to close down opposition for new entrants
- Diffusing innovation e.g. BedZed
  - how does policy do this?
  - does it do this?
- Policy makers assume will diffuse?
- Innovations not typical of mass market – embedded innovations, most visible but challenging for incumbents
- Innovators within incumbents – how to help
  e.g. from Health & Safety – legislation has diffused the culture
  CPD in low-carbon
- Role of policy 'disrupters' to shake up incumbents
- RO versus feed-in → encourages new entry
  ↓
  incumbents
- Policy model, EEC, RO is obligation on incumbents rather than triggering new players
- EEC can provide opportunity for new players
- Market becomes dominated by investment
  obligation for government to maintain e.g. small insulation companies
- Smart metering – linked to feedback rather than new technology
- ESCO provision for sites → tender → disruptor
- Requirements on incumbents → confidence to deliver versus less certainty for outsiders
- Less policy → space to emerge?
  e.g. RO versus feed in
  policy makers prone to try and catch new players rather than provide space, including competition policy
- Government departments like certainty of delivery
- Trade associations
  - effective bringing SMEs together
  - but energy efficiency less coherent
- Regulation arises from concerns around monopoly power not concerns around CO_2
  → Need to re-structure and rethink
- Car industry forced to work with SMEs via regulations on emissions

- Can government pressure hundreds to innovate?
- Incumbents can be privileged by e.g. land banks in housing industry
- Innovation policy ties up with competition policy

→ need thought re link between competition and innovation policy

- But incumbents not necessary best source of innovation e.g. forcing energy companies → ESCO not necessarily best

Group B

- Is this a false divide?
  What are incumbents and outsiders? Do outsiders just mean SMEs? Incumbents relates to those in the existing market and outsiders have the ideas, but have a harder time breaking into the market
- The status quo is not innovation – it's what we've currently got
- Do the low carbon movements come from incumbents or outsiders? – this is what we should focus on, e.g. wind innovation: it took a long time for incumbents to fully capitalise on the market
  - In Germany / Spain differing institutional frameworks have impacted on whether incumbents / outsiders have been able to capitalise on wind technology
  - Small companies have a harder time breaking into the markets
  - Market rules, insurance costs all make it difficult for smaller companies
  - The small players are also in competition with each other
  - Are innovators bringing forward ideas
- Green tariffs are an example of how small companies ideas have seeded larger companies
- The regulatory framework needs to be improved – even skewed or remove negative skews to enable the outsiders to come through
- Many costs e.g. changes to infrastructure are beyond the smaller companies
- Businesses such as energy advising and home improvements for example are much easier for smaller companies than large ones to progress – smaller companies have better means of doing this
- New entrants could be given additional support to break into the market
- Energy targets may be the driver for regulatory change
- The area we need to target is demand – and small companies are best placed to do this
  - Can smaller companies really deliver this?
  - The larger companies have a role to play too – and certainly have the incentive to achieve the generation level required
  - The incumbents need <u>more</u> encouragement to ensure this happens
  - Marketing can act as a driver – e.g. in India tariffs are set such that if you consume below a certain level, your energy costs are much lower
  - None of the UK companies are brave enough to take this forward – they fear the competition and being disadvantaged
  - Hard to heat homes and large families for example could be disadvantaged
    - Measures could be added to overcome these difficulties
    - Yes, you just need to introduce a new pricing model – this has happened in the airline business
- Innovators have often broken away from big companies and have set up in their own right as they have been frustrated by lack of willingness to innovate in the larger companies
- Opening up innovation to wider group of s/h:
  - Includes academics
- Are examples of innovation success a result of opening up?

It is very difficult for SMEs to become involved, especially the smaller ones
It is difficult to represent small business in the policy process – yet they represent a large proportion of those who should be involved

4.2a) How can the development of innovation policy open to a wider set of stakeholders?

Group A

Lack of ESCOs – transaction costs of new business model
Energy companies' regulation – gives sales incentive
Regulatory incentives affect energy companies' approach to consumers

Variable acceptance of environmental technologies and attitude to green issues → consumer segmentation
Some common segments are active innovators / others will resist, e.g. energy demand management

Economic climate → disposable income
Could drive either: extra eco-speed or thrifty purchasing

- Value of boundary spanning organisations, e.g. some NGOs, University Departments and professional associations
- Consultation is time consuming
- One site for all consultations would make it easier
- Devolved government versus Westminster
- Framing of the consultation can exclude input
- Is consultation model effective
- Scandinavian countries – ministerial access is more open
- Enron access to government = example of too much influence
  Political process not transparent, e.g. public should know UK pressured by US re power station policy
  Scandinavia would have been more open
- Co-operation between civil service departments can be disrupted by Treasury
- Diverse range of departments involved in Climate Change policy → high risk of veto re policy
- Energy efficiency industry = SMEs with little involvement in structure of policy for delivery
- Royal society / academy – remarkably influential on government
- Academics – heterogeneous community, why don't they get involved? Contribute content and process
- Voters?
- Cross-party committees can transcend politics → longer lasting political consensus; less power than in the past
- Is there any ideological debate?
- Involvement versus meaningful involvement = Distinction
- Media affects agenda but doesn't define response
- CBA – government can't do unless what asked for is cost effective
  - Who are stakeholders? e.g. AEA industry contracts → influence TAs
- 'Policy Community' quite insular but will influence re policy makers acceptance; advice e.g. EST / Carbon Trust
- Turnover of civil servants → loss of expertise
- Technical expertise declining in government
- Particular feature of the policy system that ½ mile of Westminster very powerful
- University / NGOs already engaged, respond to consultations; e.g. WWF building policy
  - Assumes consultation plays role in policy, e.g. nuclear
- Government aware of this → watchdogs
  But incumbents better placed to engage
- Policy process has opened up marketing
- Ability of multi-nationals (companies and NGOs) to engage is hugely different from other players

- Difference if people have interest in products → bins;
  Start-ups have less credibility in policy world, lack confidence in decisions
- Can build via partnerships with big firms
- Government can pay for technical assessment

4.2b How can those stakeholders insufficiently engaged in innovation policy be brought into its development more effectively?

Group A

More deliberative approaches to bring in SHS
→ Bringing together climate change, innovation and social / civil attitudes could be a way of engaging, e.g. around smart homes, transport
'Civil Society' – who? And how representative? eg. Transition Towns
How much manage centrally versus self selection
Implications of e.g. distributed generation for governance → lower / closer levels
→ Get away from Whitehall focus / obsession
Set visionary C goals – will pull people in. Merton rule has got people talking to each other who wouldn't have.
Measures can combine and build their effects, e.g. car clubs and congestion charge → lower ownership?
Buying service versus a product B2B and B2Customer, e.g. buying heat / hot water rather than a boiler
Car clubs – no-brainer for e.g. new build houses in London where parking is £
But ownership → status not just use value
Policy can affect e.g. parking.
Japan – size limits on cars one is allowed to use on-street parking.
But beware unintended consequences and think about your overall package.
Need for businesses and local communities to discuss → transition movement.
Fiscal measures e.g. treatment of car clubs for tax.
Problem re SMEs – designing markets – lots of companies supplying, so not a problem
Needs of social entrepreneurs
Help define the market – what the needs are
Problems of non-protectable IP
So, hard to attract Venture Capital for e.g. new ways of doing energy efficiency
Swedish Nutek – put out requests for new products, e.g. windows / lights, similar to specification for 1st train led to Stevenson's rocket
Out-come driven innovation
Not public procurement → setting the spec; more difficult for a service not product?
Value of a broader frame to encourage greater diversity of involvement
Agency problem – people don't feel it's what they do

- Examples of sophisticated on-line consultation, e.g. IEA
- Potential for local-level engagement for voters
- Competing ideologies? Cross party distinctions? → little scope for voting expression
- Touchstone areas, e.g. aviation, nuclear power represent issues around voter engagement
- Problem of lack of voter information, e.g. relevant TV / Radio programmes, incl. local issues → local and national media role
  Need to report and inform
- Good web links for more detail from media

- Link between local authorities and people as space for innovation
- Multi-national / European level
  - UK based stakeholders excluded
  - Energy labelling in buildings = e.g. where European driven UK impetus for innovation

  - British companies have people at the table
  - European policy on how engage stakeholders defines who involved
  - Sense that more 'dinners' going on at EC level
  - Review of labelling policy – consultation to involve UK in discussions
  - Raft of policies driven by Europe – where would UK policy be without it?
- Small business: responsibility of BERR to get to easier market share opportunities or ETI / Carbon Trust to focus on SMEs

Hire companies, e.g. Avis → distributed parking spaces

Big / small joining up to facilitate innovation

APPENDIX 5: Briefing note for workshop participants

by Adrian Smith and Florian Kern, Sussex Energy Group

This briefing note sets the scene for each issue to be discussed in the workshop. We encourage you to read this before the workshop. Our critical issues in energy innovation policy are:

1. Technology priorities and portfolio appraisal
2. Long-term signals and adaptable policy
3. Social innovation and technology fixes
4. Incumbents and outsiders in UK energy innovation policy

In each case, this note sets the scene and discusses some of the associated dilemmas. The focal questions for workshop activities are posed at the end of each issue.

Workshop issue 1: Technology priorities and portfolio appraisal

Until recently, the UK government was committed to non-discriminatory support mechanisms for low carbon energy technology deployment. The IEA praised the UK for its emphasis on market-based instruments, but with qualifications. The IEA believe "market-based policies have not ensured innovation and deployment of new energy technologies to address the long-term challenges facing the UK…It is likely that both direct incentives for carbon reduction *and* incentives for innovation in lower carbon technology will be necessary".[i] The IEA, in line with other commentators,[ii] argues policy must guide research, development, demonstration and deployment of low carbon technologies.

Change is in the air. The 2007 Energy White Paper suggested banding the renewables obligation into support levels differentiated by technology would increase "development and deployment of a broader set of renewables technologies".[iii] UKERC was set up to provide a better overview of low carbon innovation; the Energy Technologies Institute forges research links with business, and it has given initial priority to offshore renewables; public RD&D spending has risen substantially and devotes considerable attention to certain areas, such as smart metering. Other low carbon technologies are supported through grant programmes (different levels of grant are available for different technologies under the low carbon buildings programme), or by co-funding demonstration plants (e.g. full scale post-combustion coal-fired carbon capture and storage) or, arguably, reforms to the planning process (as with nuclear). As the IEA suggest, perhaps the UK is edging towards an explicit, comprehensive energy technology policy?

However, critics consider energy innovation policy to suffer from a continued lack of co-ordinating oversight for technological priorities. They point to the absence of a single authority responsible for energy R&D priorities, currently set by individual departments, or arms length organisations like the Carbon Trust and the Technology Strategy Board. Mitchell argues technology specific mechanisms like feed-in tariffs are less expensive than competitive schemes, deliver better results and have other benefits such as fostering diversity of technologies.[iv] Others argue technological prioritisation risks repeating costly mistakes associated with 'picking winners' in the past, and that carbon taxes or permit systems provide the best incentives for innovation.[v]

Whatever the arguments, Watson suggests 'picking winners' happens informally anyway, and ought to become more explicit and strategic. Government wants its policies to support future winners rather than losers. The track record on technology support is mixed, and not as negative as popularly supposed. Limited government resources require prioritisation and co-ordination so that they are not spread so thinly that their impact is slight. In this view, innovation policy should openly and transparently acknowledge the different stages of development for alternative technologies and be technology specific rather than generic.

Furthermore, innovation policy should seek a variety of complementary technologies, which together contribute to an embryonic low carbon energy system. However, some candidate technologies have huge infrastructural requirements, such as hydrogen, which hold resource implications for other technologies. Innovation policy has to support portfolios of options which 'fit together', and account for different technological requirements in terms of supportive infrastructures, skills sets, degree of commercialisation, future market opportunities, user contexts and application domains, and so forth. When bringing technologies together into a portfolio, it is important that policy-makers consider these differences, and similarities, and how they might align and link. A portfolio approach enables the government to stimulate diversity for reasons of security of supply reasons,[vi] or minimising fuel price risks,[vii] or promoting further innovation through creative learning across diverse technologies.[viii]

So what are key rationales and selection criteria for a more active and discriminating energy technology policy? Existing appraisal methods, such as cost-benefit analysis, may not be adequate for this kind of portfolio-based approach. The Carbon Trust's Low Carbon Technology Assessment prioritises technologies "that offer the greatest carbon saving potential and where support from the Carbon Trust can be material in bringing them forward" (Carbon Trust 2007c).[ix] Watson suggests broader selection criteria that include current costs, potential future costs, risks, diversity of different portfolios, the potential for UK competitive advantage, and the stage of technological development.

Key policy-relevant questions to be discussed at the workshop

1.1 What are the key rationales and weaknesses of technology specific policies beyond R&D support and carbon pricing?

1.2 What criteria should the government use to select the technologies it supports?

1.3 What additional criteria should be used to choose the right portfolio of technologies to support?

Workshop issue 2:Long-term signals and adaptable policy

Business often seeks relatively stable policy frameworks that set clear, long-term goals and within which they can develop their business. The negotiated targets in Climate Change Levy Agreements form one low carbon policy example. Carbon reduction targets in the Climate Change Bill will introduce longer term certainty across the economy, and will provide a stable framework for investors. It is also hoped that the five yearly budgets will reduce volatility in carbon prices and strengthen them.

Research has indicated that minimising risks for investors is a major contributing factor to the success of renewable energy policy in Germany.[x] In their Renewables Innovation Review the DTI and the Carbon Trust acknowledged this point and stated

"that countries that have successfully and cost-effectively deployed renewables on a wide-scale, such as Spain and Germany, have a clear, coherent set of long-term policy measures". [xi] Long-term signals facilitate the calculations that make risks manageable. However, such signals need to be strong as well as clear if they are to prompt shorter-term responses. Parker argues it is unclear how targets under the Climate Change Bill will tie in specifically with short-term energy measures.[xii]

Policy decisions over infrastructure development, in particular, and how to pursue centralised or decentralised pathways, or some combination, pose a challenge (Unruh 2000: 817).[xiii] Large low carbon infrastructure investments require long-term assurances that give investors confidence to commit to change now.

However, research into sustainable innovation recommends policies that are adaptable to emerging circumstances and the unanticipated consequences of earlier policy interventions.[xiv] Policies need to build in flexibility and be open to the positive and negative lessons generated by changing circumstances - but without disrupting investor confidence or trust in the overall innovation process. Too much flexibility may create uncertainty. Frequent changes in policy support can be counter-productive.[xv] Investor perceptions of risks are an important consideration in policy design to support low carbon technologies.[xvi] The challenge for policy is to strike the balance between sending clear long-term signals whilst retaining room to adapt to emerging circumstances.

How can energy innovation strategy reconcile this tension between certainty for investors and flexibility of policy to react to changing circumstances? Adaptable support policies require mechanisms capable of assessing innovation trajectories against long-term goals, that learn from experiences, and reconsider the options. Given the difficulties of measuring success objectively, a combination of qualitative and quantitative criteria may be desirable in policy appraisal and review. [xvii] The literature on 'transition management' makes some interesting suggestions.[xviii] Here scholars suggest evaluators look beyond immediate effects (like performance criteria) and include the contribution a policy makes to the overall transition process in the energy system. Process-based criteria, concerned with things like stakeholder inclusion, or the kinds of learning being generated and implications for future policy, may be quite different to performance-based criteria. Important lessons arise from failures as much as successes. However, the pressure for policy-makers and developers to demonstrate success can obscure valuable lessons arising from failures.

Key policy-relevant question to be discussed at the workshop

2.1 How can energy innovation policy provide stable incentives for low carbon innovation whilst remaining sufficiently adaptable to learn from experience?

Workshop issue 3: Social Innovations and Technology Fixes

Transforming the UK economy to a low carbon economy is not just a technological challenge. It requires changes in infrastructure, regulations, institutions, business models, consumer behaviours and life styles. It is impossible to think of technologies without linking to the social contexts of development and use that give those technologies meaning and effectively make them work.[xix] Policy makers have long realised that purely 'technology push' approaches will not suffice in tackling climate change.[xx] The question is how this social dimension translates into energy innovation policy.

The 'social' is important in two distinct yet related ways. First, innovation is an inherently social process conducted amongst networks of people working within social institutions. Technology innovation policy has to attend to these social dimensions. Second, innovations can be social in nature as well as technological, such as new lifestyles, business models, and consumer practices. Innovation policy needs to become inclusive and supportive towards these social solutions. The idea of energy service companies selling services like 'a warm house' or 'lighting' rather than x cubic meters of gas or x kWh of electricity is an example of a social innovation that has caught the imagination in energy policy.

Attending to the social dimensions of innovation, involves policy in the provision and support of skills, social networks, ideas, financial expectations, user relations, knowledge translation and so forth that helps make low carbon technologies and practices evolve and spread.[xxi] Social processes underpin the development and use of low carbon technologies, and insufficient attention to them can impede the development of new 'socio-technical practices' on the demand side that reduce business and household carbon footprints. For example technology development and R&D depends on highly skilled scientists, sometimes in emerging disciplines like bioenergy; expanding the deployment of solar heating technologies implies sufficiently trained plumbers. The success of a range of low carbon technology initiatives, ranging from the Technology Strategy to the Carbon Trust, the National Energy Technology Institute to the Energy Programme of the Research Councils, rests partly upon their engagement with these social processes.

The second challenge is to take social innovations seriously. Sometimes they fall below the radar of official *innovation* policy, such as car clubs, energy service models, green concierges, financing packages. [xxii] This is not always the case. Social innovations like personal carbon allowances receive considerable policy attention. But this is usually outside the innovation policy domain and a matter for policy-makers working on behavioural change, green consumption or public participation. And yet these initiatives are essential for the diffusion low carbon technologies on the demand-side. Indeed, these initiatives benefit from technological support, such as online IT systems and smart cards for car club bookings. Should energy innovation policy stick to technology policies (like supporting basic research, R&D, or demonstration projects)? Or can it provide a fresh perspective and open up 'behavioural change' policy, say, and help nurture social innovations? Should innovation policy attend, for example, to community development models appropriate for renewable energy at that scale? The particularities of different communities, and the community renewable models they develop and deploy, can make it very difficult to scale-up these initiatives and move them into other contexts.[xxiii]

An open question for energy innovation policy is thus how to support, incorporate and learn from those new social initiatives that are quite different from mainstream business or social practice, and how to help to translate those ideas into wider consumption and production practices. This might simply involve energy innovation policy-makers working more closely with other policy domains, and provide helpful lessons about the way new ideas and socio-technical practices spread and exert influence. Or it could involve an extension of innovation policy into these social domains.

Key policy-relevant questions to be discussed at the workshop

3.1 How can innovation policy attend to the social dimensions of the innovation process?

3.2 What would be ways to encourage social innovations such as new business models, lower carbon lifestyles and changing behavioural patterns and routines?

Workshop issue 4: Incumbents and outsiders in UK energy innovation policy

This critical issue has two facets to it. First, focusing on innovation, the ways policy can help a broader variety of innovators and innovations. Second, focusing on policy making, considering how a greater variety of stakeholders can be included in policy development.

Innovation studies suggest processes for learning across diverse initiatives is important. People able to think 'outside the box' can make important contributions to radical innovation.[xxiv] The interests that these 'outsiders' have in existing production and consumption systems tend to differ from the interests of incumbent firms, who carry more 'sunk costs', and whose routines and experience ties them more to existing trajectories of development. This is why "[d]isruptive technologies rarely 'make sense' to incumbents, so that their development tends be left to small, outsider organisations". [xxv] Conversely, newcomers can struggle to develop their radical innovations in niche markets, but which, if successful, can disrupt and deflect the mainstream trajectory of development.[xxvi]

Established power plant manufacturers have, for example, found it difficult to absorb the relevant manufacturing capabilities for distributed generation markets, since their traditional strength rests more in centralised systems integration capabilities. If exploiting new technologies favours new organising principles and structures, then incumbent companies can struggle to promote commercialisation of such technologies (or even resist it).[xxvii] At the same time, incumbent energy companies have resources like knowledge, expertise, commercial credibility, finance, and markets that are central to successful low carbon innovation processes.

Conversely, a recent NESTA report called for policy that supported disruptive innovators, who were developing, "cheaper, easier-to-use alternatives to existing products or services often produced by non-traditional players that target previously ignored customers".[xxviii] Their study included examples like a green concierge service, which helps people make their households lower carbon, a smart-metering start-up led by design graduates, and a novel photovoltaic system integrated into office windows. Fine tuning innovation policy to the needs of newcomers offering low carbon ideas can be difficult (e.g. low visibility, lack of track record, insecure basis for the business). However, this is not necessarily an issue of small versus big players, but of incumbents in a particular field versus newcomers, which can also be large companies themselves. Smart metering innovations might see firms that already provide information to households, like BT, Virgin or Microsoft, entering the energy domain.

Partnerships are one means for facilitating exchanges between different groups. However, they need to be facilitated with care. Some organisations find it easier to participate than others (see below). It is important that all partners are assured a voice. Successful partnerships will draw upon the respective advantages across the membership, whilst overcoming potential antagonisms. Policies can support single, comprehensive partnerships; or they can promote plural partnerships, organised by affinity and working in parallel. In the latter case, processes for learning *across* partnerships and initiatives become essential.

An interesting example of the challenges in partnerships for innovative diversity is the 'low carbon vehicles partnership'. This was intended to lead a shift to low carbon vehicles and fuels. It was announced by the Department for Transport in their 2002

Powering Future Vehicles Strategy, and intended to play a key role in delivering the strategy. [xxix] The partnership includes car companies, oil companies, several government departments and agencies, Universities and NGOs. The main goal is to promote sales of low carbon vehicles and fuels, and to provide advice to the government. Whilst these present considerable innovation challenges for incumbent players, looked at more broadly it still represents an incremental improvement of the existing automobile transport system, rather than a structural shift to new forms of mobility and logistics.

Whilst this broader view is outside the remit of the LCVP, the DfT strategy for low carbon transport innovation explicitly mentions it as a key stakeholder group. [xxx] Government may identify and invite innovative 'outsider' stakeholders to participate in these initiatives, but they may be reluctant to take up the offer. A Sustainable Mobility Partnership might provide a more meaningful network and agenda for them. Either way, people who have dissenting ideas can find it difficult to engage with partnerships.

Government looks to these partnerships for input to policy development as well as delivery. Broadening the variety of stakeholders involved in the development of policy, whether through partnerships or other means, could lead to a suite of approaches tailored to a wider set of innovator and innovation goals and circumstances. Similar challenges prevail to those above. Typically, larger players will have much more time and resources available to commit to policy development. Their visibility is more immediate to time-pressed and Whitehall-based policy-makers seeking to engage with stakeholders. Opening-up policy development around innovation to a variety of players, small and large, established and new, resourced and fragile, is a critical issue for policy.

Key policy-relevant questions to be discussed at the workshop

4.1 How can policy-makers support a broader variety of incumbent and outsider innovators?

4.2 How can the development of innovation policy be opened to a wider set of stakeholders?

APPENDIX 6: WORKSHOP PROGRAMME

Critical issues in UK low carbon energy innovation policy

4th and 5th February 2008, St. Hugh's College, Oxford

A 2-day residential workshop which brings together research perspectives and practitioner experiences in UK low carbon innovation policy and will aim to draw out robust insights for future energy innovation policy.

Day 1 Monday 4th February

9:30 *Registration and welcome refreshments*

10:00 **Welcome and overview of the workshop**
Prof. Gordon MacKerron, director, Sussex Energy Group (Welcome)
Jennifer Otoadese, UKERC Meeting Place and Maeve O'Keefe, Environment Council (Workshop process)

Context Setting presentation: UK energy innovation policy and critical issues for future strategy
Dr. Jim Watson, deputy director, Sussex Energy Group

Issue 1: Technology priorities and portfolio appraisal.
Short Intro Presentation
Participants then discuss the following three questions in groups:

1.1 What are the key rationales and weaknesses of technology specific policies beyond R&D support and carbon pricing?

1.2 What criteria should the government use to select the technologies it supports?

1.3 What additional criteria should be used to choose the right portfolio of technologies to support?

Review and discussion of group outputs

13:00 *Lunch*

14:00 **Issue 2: Long Term Signals and Adaptable Policy**
Short Intro Presentation
Participants work on exercises to answer the following question in groups:

2.1 How can energy innovation policy provide stable incentives for low carbon innovation while being adaptable to learn from experiences and failures?

Comparison and discussion of group outputs

Refreshment break

Issue 3: Social Innovations and Technology Fixes
Short Intro Presentation
Participants then work on one of the following questions in groups:

3.1 How can innovation policy attend to the social dimensions of the innovation process?

3.2 What would be ways to encourage social innovations such as new business models, lower carbon lifestyles and changing behavioural patterns and routines?

Display outputs of group work and feedback from Participants on day 1

18:00 Adjourn

19:00 *Pre-dinner drinks, St Hugh's College (tbc)*

19:30 Dinner, Wordsworth Room of St Hugh's College

dinner speaker: **Dr. David Clarke** (Chief executive of the Energy Technologies Institute): "Where are we so far and what are our future priorities?"

Day 2 Tuesday 5th February

Refreshments available from 8:15.

8:45 Review of Day 1 and Overview Day 2

Issue 4: Incumbents and Outsiders in Low Carbon Energy Innovation Policy
Short Intro Presentation
Participants then discuss the following two questions in groups:

4.1 How can policy-makers support a broader variety of incumbent and outsider innovators?

4.2 How can the development of energy innovation policy be opened to a wider set of stakeholders?

Refreshment break

Bringing together and discuss group results

Synthesis session I: reviewing results

13:00 *Lunch*

14:00 **Synthesis session II:** reviewing results and discussing policy recommendations emerging from the four issues

15:15 **Closing remarks and Next steps**

15:30 Close

APPENDIX 8: Workshop Attendee List

First name	Surname	Organisation
1. Paul	Allen	Centre for Alternative Technology
2. Allan	Asher	Energy Watch
3. John	Bristow	Transition Brighton and Hove
4. Mike	Colechin	E.ON. UK
5. Nick	Eyre	Environmental Change Institute, Oxford University Centre for the Environment
6. Tim	Foxon	SRI, University of Leeds
7. Robert	Gross	Imperial and UKERC
8. Michael	Harrison	Defra Climate Change Group
9. Mark	Hinnels	Environmental Change Institute, Oxford University Centre for the Environment
10. David	Joffe	Shadow secretariat, Committee on Climate Change
11. Florian	Kern	Sussex Energy Group, SPRU, University of Sussex
12. Filomena	La Porta	Technology strategy Board
13. Kate	Levick	UK Office of Climate Change
14. Gordon	MacKerron	Sussex Energy Group, SPRU, University of Sussex
15. Robert	Morgan	Ceres Power
16. Kathryn	Newell	BERR
17. David	Ockwell	Sussex Energy Group, SPRU, University of Sussex
18. Kannan	Ramachandran	King's College London
19. Alister	Scott	Sussex Energy Group, SPRU, University of Sussex
20. Adrian	Smith	Sussex Energy Group, SPRU, University of Sussex
21. Fred	Steward	Brunel University
22. David	Vincent	The Carbon Trust
23. Jim	Watson	Sussex Energy Group, SPRU, University of Sussex
24. Mark	Winskel	University of Edinburgh

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