UKERC
UK Energy Research Centre

MEETING REPORT
RESEARCH FUND TOWN MEETING – LONDON, DECEMBER 2015

ABOUT UKERC

The UK Energy Research Centre (UKERC) carries out world-class, interdisciplinary research into sustainable future energy systems. It is a focal point of UK energy research and a gateway between the UK and the international energy research communities. Our whole systems research informs UK policy development and research strategy.

UKERC is funded by The Research Councils UK Energy Programme.

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1 Introduction

The UK Energy Research Centre (UKERC) is in its third five-year phase of research and engagement activities, which will run until April 2019. In addition to the core programme of research, a number of mechanisms have been put in place to ensure that participation in UKERC is broad, flexible and addresses the needs of the wider UK research community.

A flexible Research Fund of around £3.3m (valued at 80% FEC) has been set up in order to commission new research and facilitate the integration of the existing programme. The Research Fund is overseen by UKERC's independent Research Committee. The key aims of the Fund are:

- To allow the research programme to develop flexibly in the light of new scientific insights or external developments, e.g. in energy policy;
- To bring a wider range of researchers and disciplines into UKERC's research programme, including researchers from outside the 'traditional' energy community;
- To promote integration in the UKERC research programme, and to fill gaps where needed;
- To build collaborations between the UKERC research community and other research communities – including other energy researchers, groups and centres; and
- To scope and develop new research agendas in partnership with funders, the research community and other stakeholders.

The Fund is being allocated through three consecutive targeted calls for proposals, taking place in 2015 and 2016. Each funding call is preceded by a round of consultation among the UK academic, policy and industry communities. The allocation of the first round of funding was completed in late 2015. The successful projects were selected following a competitive two-stage application process that was led and overseen by the Research Committee. Full applications were subject to independent peer review, and four projects were chosen for funding.

On the 10th December 2015 a workshop was held at Imperial College in London in order to discuss potential topics for the second round of funding. In this instance the discussion built on the priority areas that were identified

in the first consultation round[1]. Following a presentation on UKERC's core research programme and an update on the first Research Fund round, the attendees were split into three groups and participated in a series of facilitated breakout sessions that focussed on each of the key research areas. In the final session of the day the attendees had the opportunity to vote for the suggested research areas they thought should be prioritised, as well as write down on post-it notes specific research ideas.

This report presents the discussions that took place during the workshop. Section 2 outlines the outcomes of the voting exercise. Section 3 synthesises the key points that were discussed during the day regarding each of the research areas. Specific suggestions on research questions that the attendees made on post-it notes during the voting exercise are set out in Appendix 1. The detailed outputs from each of the breakout sessions are presented in Appendix 2.

1.1 Key research areas

On the day of the workshop the discussion focussed on the research areas that are outlined below. These are based on priorities that were identified in the first Research Fund workshop, but were not prioritised for funding during the first round. These priorities were subsequently discussed and modified by the UKERC Research Committee. Some background information on the research areas that resulted from this process were provided to the workshop participants in advance. This can be found in Appendix 3. In addition to these priority research areas, participants were also given the opportunity to suggest research areas that were not included in this list.

The priority research areas are as follows:

1) Assessment of bioenergy with CCS (BECCS)
2) Electricity and energy storage
3) Community engagement and energy systems
4) Implications of 'non-optimal' energy systems
5) Linking research and practice for local energy systems

[1] http://www.ukerc.ac.uk/publications/ukerc-flexible-research-fund-town-hall-meeting.html

6) ICTs and energy system change
7) International comparison of efforts to reduce consumption
8) Energy efficiency: claimed vs actual performance
9) Impact of non-energy policies on the energy system
10) Acceleration of timescales for emissions reduction

These areas were discussed in detail during breakout sessions. The only exception is ICTs and energy system change. Since this is a particularly broad area, the Research Committee advised that it may be preferable to arrange specific discussions on it and/or further work to scope out the existing research landscape and potential opportunities for UKERC.

2 Prioritisation of the research areas

At the end of the workshop a prioritisation exercise took place, where the participants voted for their preferred research areas. Each participant was allocated three votes. The voting refers to the overall area, not the individual ideas within that area that were discussed in breakout groups. In case of research areas that were not included in the original list of priority areas, the participants were asked to vote for individual research ideas. Therefore only new ideas that received any votes are included in the table. The results of the exercise are set out below.

Table 1 Results of the voting exercise

Ranking	Research area	Votes
1	Energy efficiency: claimed vs actual performance	16
2	Electricity and energy storage	14
3	Community engagement and energy systems	10
4	ICT and energy systems change	9
5	Impact of non-energy policies on the energy system	8
6	Assessment of bioenergy with CCS	4
7	Acceleration of timescales for emissions reduction	4
8	Implications of 'non-optimal' energy systems	4
9	International comparison of efforts to reduce consumption	2
10	Linking research and practice for local energy	1

	systems	
11	**New research areas suggested at the meeting:**	
	Understanding the impacts of uncertainty in a nuclear programme	2
	Changing building (housing) policy and energy implications	1
	Timing of all scales: day, week, year	1
	Transport and energy at different scales	1
	Urban air quality associated with (domestic) wood stoves	1

3 Summary of key points

This section presents a synthesis of the key themes that emerged from the discussions about the research areas during breakout groups, and from suggestions that were made throughout the day on each area via post-it notes. The research areas are discussed in order of the number of votes received.

1) Energy efficiency: claimed vs actual performance: *16 votes*

There was a consensus about the need to clarify what is meant by 'efficiency' and how this issue is approached in research. The difficulty of not having a single metric against which performance can be measured was discussed. It was suggested that research under this topic would provide an opportunity for lesson-learning from international experience and could therefore link to the international comparison research area.

Many of the suggestions centred on the building sector and the opportunity for learning from housing developments at different stages. The problems arising from the knowledge gap in skills for the installation of new technologies and the effect on the real performance of different technologies, such as ground source heat pumps, was discussed. It was suggested that it would be beneficial to review and analyse the existing

literature and data on performance gaps before commissioning a full new research project.

2) Electricity and energy storage: *14 votes*

The workshop participants acknowledged that new research in this area should be broader than technology development issues. Specific topics that were discussed included the barriers to storage uptake, the role of costs and the market mechanisms that would be required to support storage. The importance of user engagement was also considered. At the domestic level a potential approach would be to examine public perceptions about storage technologies and explore how domestic thermal storage could be made more attractive to users. Another option would be to explore storage at a community level, therefore creating potential links to the community engagement research area.

The long-term potential for storage in the wider system was also highlighted. The role of inter-seasonal storage in future energy systems and the links between district heating and storage were identified as potential research areas. On the other hand, it was suggested that it would be preferable to focus on resilience in general and how it can be achieved, rather than storage in isolation from other means of achieving resilience.

3) Community engagement and energy systems: *10 votes*

While it was acknowledged that a lot of research in this area has already been commissioned, the workshop attendees expressed the view that there would still be merit in pursuing further research. Any new research would have to have a wider remit than the DECC Community Energy Strategy. It was suggested that the clarification of the term 'community' would be beneficial. One approach would be to identify the characteristics of community energy groups and their associated projects. In that case it would be possible to explore the different effects of community energy schemes, e.g. what levels of demand reduction or wider behaviour change are achieved. Another suggestion was to explore the differentiation between urban and rural communities.

Furthermore, a focus on co-design and community-led research was suggested, providing potential links with the research and practice for local energy systems research area. It was noted that such an approach could possibly facilitate interdisciplinary research; however the difference between engagement and community energy, and the actual co-production of the energy system was highlighted. Access to finance and de-risking innovation for community schemes were also identified as potential topics. Finally, other future research ideas addressed the role of policy in supporting community energy schemes and the impacts of the changing UK policy landscape.

4) ICT and energy systems change: *9 votes*

As this is such a broad area, the Research Committee advised that it may be preferable to arrange specific discussions on it and/or further work to scope out the existing research landscape. Therefore no detailed suggestions were made regarding potential opportunities for UKERC. However the workshop participants still had the opportunity to vote for this area in the prioritisation exercise – and it proved to be relatively popular.

5) Impact of non-energy policies on the energy system: *8 votes*

This research area would be novel to UKERC. However any new projects would have to acknowledge already ongoing research by other partners; in particular the DEMAND Centre led by the University of Lancaster. Several potential case study policy areas were identified during the workshop; for example education, transport, housing, food patterns and the effects of increasingly ageing populations were mentioned.

The issue of scale was also emphasised. In particular, a suggestion was made to identify what policies have been transformative at a local or urban scale.

6) Assessment of bioenergy with CCS: *4 votes*

During the workshop it was clear that there is interest in the area of negative emissions technologies overall, and not only bioenergy with CCS (BECCS). This issue would be of particular interest to policy makers. The focus of the discussions was less on technology development and more on the wider implications of the system integration of such technologies. The inter-generational, justice and ethics issues about BECCS were highlighted as being particularly worthwhile to pursue.

From a systems perspective, it was highlighted that it would be beneficial to explore the assumptions that are made about the role of BECCS in global energy scenarios and their implications for the wider energy system. The interactions between BECCS and the wider economy were also identified as a topic for future research. Other potential areas of future research include costs, the existing barriers and the role of policy incentives in facilitating BECCS.

7) Acceleration of timescales for emissions reduction: *4 votes*

The workshop participants recognised that while topical, this issue may be quite difficult to model due to unpredictability. One option would be to explore examples of accelerated emissions reductions from other countries in order to identify lessons for the UK. Different approaches that were suggested included examining whether lessons can be learned from other sectors, e.g. ICTs; and focusing on the scope for acceleration a particular part of the energy system rather than a system as a whole.

Furthermore, it was suggested that it would be interesting to focus on the role of legislation and compare the impact of targeted support versus market mechanisms. The issue of different rates of change between technologies, e.g. PV vs nuclear, and the resulting challenge in creating a balanced system were also brought up. A relevant research question could focus on how the targeted acceleration of a specific technology would interact with the rest of the energy system. Overall, it was agreed that this is a promising area, particularly given the outcome of COP21.

8) Implications of 'non-optimal' energy systems: *4 votes*

Discussions around this topic emphasised the need to be more specific about what 'optimality' means and whether it refers to particular population groups or scale of the energy system.

A research question could be developed about how different future energy system pathways might favour different groups. A difficulty in measuring optimality and determining a future counter-factual was also noted. Overall, there was an agreement that it would most likely be beneficial if the language framing of this research area is modified so it does not focus on 'optimality' per se. For example it was recommended that the focus should be shifted to identifying trade-offs or the achievement of resilience in the long-term, instead of optimality.

Another key issue that came up in the discussions was the role of energy system models. It was largely agreed that cost optimisation models fail to take into account a number of factors, such as investment decision-making, and therefore it would be worthwhile to explore what other tools could be used. It was noted that a number of emerging models are available that could possibly help fill this gap; therefore this could be an opportunity for UKERC to support their further development by commissioning a series of modelling case studies through the Research Fund.

9) International comparison of efforts to reduce consumption: *2 votes*

Seeing that there already exists a significant amount of research on international comparison, the additionality of this research area was considered. It was decided that in order to create additional benefits the focus would have to be on lesson learning for the UK. Another interesting approach would be to explore what other countries could learn from the UK. In any case it would be necessary to be clear about how to define a valid comparison and determine what is actually comparable or not. Vernacular architecture was given as an example where the transfer of experience between countries can be difficult or problematic.

The examination of 'failed' case studies was also suggested. A differentiation between electricity, gas and transport was recommended, as the underlying trends and drivers are distinct, despite the fact that each of these areas is subject to some common economic drivers. Therefore it would be interesting to see whether similar patterns can be traced internationally. Finally, it was noted that focusing on international examples might make the research more attractive to a wider audience.

10) Linking research and practice for local energy systems: *1 vote*

The issue of scale was discussed under this area; it would be novel to explore the interconnections of different scales through multiple layers of connectivity. The risks and uncertainties regarding the interactions between the local, regional and national level were suggested as a possible topic. Another approach that was popular during the discussions was to explore consumer led-change; specifically how the system can cope with fast-paced, consumer-led change and whether lessons can be drawn from the consumer adoption practices of different technologies. Transport was given as an example, where personal vehicles are sometimes valued as status symbols.

Questions about maintaining both local systems and the grid, and the possible transition to a non-optimal gas grid were also posed. An important issue would be to determine who would be responsible for maintaining the grid, particularly if it is only used as a back-up (e.g. in case of extreme events). It was suggested that lessons could be drawn from other European countries.

Finally, the role of financing was discussed; specifically how local projects could compete with large utilities.

11) Other topics

The workshop participants were also given the opportunity to suggest topics that did not fall under any of the pre-determined categories. In this instance

the voting did not apply to the overall category but the individual research ideas. The following topics were suggested:

- Understanding the impacts of uncertainty in a nuclear programme: *2 votes*
    - Period of construction
    - Developments in the rest of the system while nuclear is constructed
- Changing building (housing) policy and energy implications: demand/ storage/ generation: *1 vote*
- Timing of all scales: day, week, year: *1 vote*
- Transport and energy at different scales: *1 vote*
- Urban air quality associated with (domestic) wood stoves: *1 vote*
- With half hourly meter readings there are more than 17.000 data points a year. Consumers are totally reliant on IT tools to compare energy deals issues.
    - Consent to use data
    - Increased price discriminations
    - How does the regulator check to ensure tools operate correctly
- Finance for energy system changes.
- Can the energy system respond fast enough to changes driven by consumer technology adoption, e.g. electric cars.
- Energy demand, supply and infrastructure: climate change impacts and adaptation.
- How to encourage longer term thinking in politicians than the electoral cycle. A political science project.
- Energy and emissions projections: reliability, uncertainty, and what that means for effective policy development and planning.
- Economic impact of low-carbon strategies that diverts a lot of resources from fuel spend to investment.

4 Appendix 1: Record of post-it notes

This section includes the post-it notes that were added to specific research areas during the workshop.

1) Energy efficiency: claimed vs actual performance

- Need to look at overseas experiences
- Lack of deterioration agenda for buildings- no MOT. How do we learn from housing developments at different phases?
- What is energy efficiency? A reflection on problems of thinking about efficiency. No single metric against which you can measure improvement.
- Imperfect installation issue. Real performance (e.g. of ground source heat pumps) vs what we are projecting. Why is this a problem and how can it be obviated? Or we could look at the existing data on performance gaps. Get data on deterioration rates for the period of installation & focus the call so that you don't get too wide a response.

2) Electricity and energy storage

- How can storage technologies be designed to take into account the reality of UK homes?
- Storage to balance the grid.
- Energy storage
    - Cross system
    - Options
    - Barriers (including space for distribution, especially thermal storage) & full costs
    - Best use (e.g. in DNOs, balancing etc)
    - Market mechanism needed to reflect value fully
- Space (domestic): householders' understanding.
- Inter-seasonal energy storage

    - Technologies
    - Local vs central
    - Impact on efficiency
- Storage of low-grade waste heat from industry or air-conditioning for use in community.
- Stop removing hot water cylinders now!
- Important to engage users/ consumers
    - Acceptability (social)
    - Retrofit (technology)
- This is a huge and significant area. Inter-seasonal storage is important and essential to our final energy system.
- Resilience of the system and how it would be delivered rather than storage per se.
- Electricity storage to link with increased renewables.
- How to make domestic thermal storage attractive.
- The role of district heating on energy/ thermal storage: how can this be valued?
- Resilience due to storage. Get rid of grid- need to store heat and electricity.

3) Community engagement and energy systems

- Co-design of energy systems: helpful to facilitate interdisciplinary research.
- Access to finance for community energy schemes.
- De-risking innovation for financing community energy schemes.
- What are the characteristics of community energy groups?
- What is the size and scale of community energy in the UK?
- Very broad area, you need to be more specific about what you are going to do.
- Social acceptability beyond economics: what are the drivers?
- Very important and relatively neglected:
    - Coal

    - MUSCos
- Not engagement: participation and action!
- Local co-design of experiments and interventions.
- Non-cost barriers to energy efficiency in different sectors, e.g. buildings.
- Incentivise developers to deploy energy storage and community energy systems through legislation and funding.
- Review of wider impacts of community energy: reductions in energy demand? Further projects? Wider behaviour change?
- Review of impacts of the changing UK policy landscape on deployment: evidence to back up or challenge the anecdotes.

4) ICT and energy systems change

5) Impact of non-energy policies on the energy system

- Does policy get in the way?
- Education: parents taking children to far-flung schools. Data exists as schools have to collect it.
- Ageing: more people being looked after at home.
- Reduction in meat consumption: measuring consequences. Other countries wanting to emulate western diets.
- Planning: case for more regulation for energy efficiency.
- Policy domains that impact on energy:
    - Transport
    - Planning: devolution, localism
    - Housing: requirements on private buildings, council house sell-offs and tenancies. Disincentives to energy efficiency, e.g. who has the legal right to connect to heat networks.
- Starting with people who study policy interactions, can we find examples of policies that have been transformative at an urban or local scale and make them visible.

6) Assessment of bioenergy with CCS

- Socio-political issues: generational, justice, ethics.
- Highly important for energy systems & pathways for carbon removal more generally.
- How much is possible, globally and in the UK?
- What cost?
- Policy barriers and overcoming them.
- Carbon abatement versus other bioenergy uses.
- Contribution to other energy challenges.
- Carbon dioxide removal (CDR) is a much wider topic than BECCS (see the National Academy of Science report). CDR is required to get to net zero emissions. Using CDR for net negative emissions is another matter with big inter-generational equity aspects.
- Should we be looking at negative emissions rather than BECCS? Carbon removal?
- Impact of BECCS on water through feedstock growth and geological storage.
- Economics and trade-offs of different pathways in the UK energy system.
- Ethics, equity & justice issues around bio-CCS.
- What are the implications of a fuller understanding of the BECCS assumptions in global energy scenarios for the rest of the energy system?
- It does not seem helpful for bioenergy and CCS to be conjoined.
- Political framing and incentives to facilitate bio-CCS.
- Political/ policy issues appear most significant for this particular area, i.e. carbon pricing.

7) Acceleration of timescales for emissions reduction

- This is very difficult to model. Timescales and learning curves are not predictable.

- Acceleration of timescales: project around planned (policy) vs unplanned (market) policies.
- Compare different actors' visions of smart systems. Expectations of timescales from e.g. telecoms? What does that mean going forward?
- Identify barriers and blocks for each scenario- can we learn from these?
- Look at examples of acceleration in other countries.
- How do we drive take-up? Consumer and industry considerations. Challenges: different rates of change, e.g. PV vs nuclear, and how you build a system that's balanced. Where are the roadblocks? Role of legislation.
- An exciting question, not limited by the negative UK policy environment. Keeps UKERC independent & offering critical friendship to government. Relevance given Paris COP21 discussion on 1.5°C and 2°C targets.
- Differentiated levels of acceleration- not the same level across the board. How would targeted acceleration interact with the rest of the energy system?

8) Implications of 'non-optimal' energy systems

- The role regulators need to play in future energy systems.
- Contested: optimal for whom/ why? Could build on UEA work on the engagement of different sets of actors (publics) in the energy system.
- Comparative cases of disruption and coping strategies. What can we learn? What is needed for resilience?

9) International comparisons of efforts to reduce consumption

- Business models for financing/ encouraging energy efficiency interventions in buildings: review of international experiences.

- Political economy of energy transitions.

10) Linking research and practice for local energy systems

- Intersections/ tensions between different energy strategies: centralised or digitally enabled vs decentralised and autonomous.
- Interaction between local, regional and national: the risks and uncertainty.

11) Other topics

The workshop participants were also given the opportunity to suggest topics that did not fall under any of the pre-determined categories. In this instance the voting did not apply to the overall category but the individual research ideas.

- Understanding the impacts of uncertainty in a nuclear programme
    - Period of construction
    - Developments in the rest of the system while nuclear is constructed
- Changing building (housing) policy and energy implications: demand/ storage/ generation
- Timing of all scales: day, week, year
- Transport and energy at different scales
- Urban air quality associated with (domestic) wood stoves
- With half hourly meter readings there are more than 17.000 data points a year. Consumers are totally reliant on IT tools to compare energy deals issues.
    - Consent to use data
    - Increased price discriminations
    - How does the regulator check to ensure tools operate correctly
- Finance for energy system changes.

- Can the energy system respond fast enough to changes driven by consumer technology adoption, e.g. electric cars.
- Energy demand, supply and infrastructure: climate change impacts and adaptation.
- How to encourage longer term thinking in politicians than the electoral cycle. A political science project.
- Energy and emissions projections: reliability, uncertainty, and what that means for effective policy development and planning.
- Economic impact of low-carbon strategies that diverts a lot of resources from fuel spend to investment.

5 Appendix 2: notes from the breakout sessions

This section outlines the detailed comments that were made in the breakout groups for each research area, as well as some general comments about the priority areas. The only exception is the ICTs and energy system change area; it was decided that if this area is to be taken forward more specific in-depth consultation will be required.

5.1 Breakout group 1

Chair: Mike Weston, UKERC
Note taker: Amber Sharick, UKERC

Topics considered

- Assessment of bioenergy with CCS
- Electricity and energy storage
- Community engagement and energy systems

Assessment of bioenergy with CCS

- DECC has a particular interest in this issue
- How much can be done?
- Costs?
- Advantages?
- Interactions with the wider system? Policy? Larger Economy?
- Ethics, Justice and Accounting around importing biomass
- Options such as BECCS versus demand reduction.
- Impacts on land-use change and water.
- Practical and logistical issues related to trade-offs and targets.

Electricity and energy storage

- Administrative and economic barriers analysis, e.g. ownership and regulation as generation:
    - across sectors, specifically including heat
    - costs at different time scales
    - include some myth busting around daily storage
- Multiple uses of storage and/or looking at characteristics of the energy system and placing value on storage's role, i.e. valuing other characteristics of the system and changing the rhetoric on storage.
- Seasonal storage versus other options, e.g. extra generation capacity that is only used in winter.
- Local versus regional issues, e.g. emergency back-up power, grid maintenance and differentiation of demand.
- Impacts of smart systems on communities in crisis, e.g. as in the Lancaster flooding (loss of communications, cashless, no heat, no way to cook food).
- Policy Interactions.
- Housing decisions and heat.

Community engagement and energy systems

- DECC is interested in this subject but it should be broader than the Community Energy Strategy.
- Co-designed community-led action research.
- Community energy & access to finance.
- Defining communities.
- Shale Gas acceptability and investment.
- Is there demand reduction associated with community energy?
- Nature and type of Community energy projects: more of a complex analysis.

- Rural versus urban communities.
- Public trust in companies, stakeholders and policy makers.
- Does trust matter? A project could be set up exploring the questions that are being asked; are they the right ones?
- Difference between engagement and community energy versus actual co-production of the energy system.

5.2 Breakout group 2

Chair: Jim Watson, UKERC
Note taker: Ioanna Ketsopoulou, UKERC

Topics considered

- Implications of 'non-optimal' energy systems
- Linking research and practice for local energy systems
- International comparison of efforts to reduce consumption

Implications of 'non-optimal' energy systems

- Optimising is a very problematic language: carries wrong assumptions- skip it and start thinking
  Priorities need articulating: there are multiple rationalities
  Why keep 'the system' going? Is it the 'right' system, or the 'right' goal?
  Generational differences: in what power is for and what the system is for
  Power is ON or OFF- no grades/ scales in everyday experience, but is a 'system' to be managed by the power providers
- Vested interests
- Salience

- Are there trade-offs for conflicts of different groups being 'optimal'- optimal for one may mean non-optimal for another
- Optimality re: heating temperatures for energy poverty. People have different heating preferences- average not optimum? Wrong energy efficiency schemes picked as human behaviour inevitably departs from 'optimum'.
- Priorities: non-rational, linked to politics/ media emphasis rather than what 'experts' think
- Learning from disruptions & social responses/ economic costs. Cumbria floods revealed lots of responses/ lessons learned: scale/ time/ space (mobility?)
- Optimised for who? Contested. Not useful to get such in optimality language? Question of priorities, rather than 'optimisation'.
- Build on J Chilvers work on publics engagement in energy from a whole systems perspective- bring in different actors as contested- 'optimal' for who/ why?
- Housing policy: dropping CfSH & GD- deleterious building policy & energy effects as non-optimal
- Sensitivity to pricing on energy bills study
- Agent-based modelling to add human choice to models
- How can energy transitions enable those that are currently under-serviced/ energy poor? Status quo is that current energy systems are non-optimal (especially in reflection to heat). Will energy transition help to bring socially vulnerable back to socially and materially necessitated levels of energy consumption? If not what are the risks (social)? What could be the coping strategies?
- International comparisons of systems & political/ industry mindsets
- Diversity of approaches. Models including optimisation- parallel exercises. Test cases of alternatives to TIMES/ MARKAL?
- Resilience vs optimality. Is this the right aim- optimal energy system for 2050?

- Mindset of decision makers- international comparison. Avoiding stranded assets… or not?
- Question of market design- costs, investors cash flow in reality
- Quality of supply. Are households essential requirements potentially different in a world of low energy apppliances.
- Optimal models: is there a role for real time power system simulation model for a more 'realistic' assessment?

Linking research and practice for local energy systems

- Forget 'local' and 'community', instead focus on relations between parts of energy systems at different scales.
  Decentralisation creates more 'scales'. Scale is not natural.
  'Security' via a grid (post-war) or via decentralisation?
  How to understand mini and macro geographies of demand?
  The disruption of electrification as a process: hardware, supply chains.
  'Corridors' and 'terminals', not 'local' as a language.
- Is local selfish? You still have to maintain the grid. If people just connect when they're short. Eg in Spain.
- Rapidity of consumer adoption of technology, eg EVs adopted at pace of smart phones. Rapid consumer adoption:5-10yrs not the standard for energy infrastructure planning
- Different scales: individual households as well as local communities. How does N Grid get financed as local/ household generation takes off? N Grid gos from essential to expensive insurance policy. Different groups are able to disconnect from the grid, those who disconnect perhaps the wealthiest as able to invest in new tech.
- Relationship between scales as the issue, not 'local' per se?
- Transport & energy interactions- infrastructure corridors and terminals, and uncertainties about interactions.

- Desirability of 'green technologies'
- Propensity to switch supplier if perceived to be 'local'
- How do local energy systems compete with regulated & subsidised energy infrastructure systems & suppliers.
- Topic vague & unfocussed. Means different things to all people. Not enough clarity to determine what the local 'nuggets' might be.

International comparison of efforts to reduce consumption

- Work more comparatively- in general, not only between countries AND be clever and sophisticated about comparative method. Also focus on 'bad' cases, not only 'good' lessons for 'inspiration' about change.
- UK is part of an international field in terms of policy ideas, actual hardware/ components. UK as an island.
- Different impacts in different areas of the energy system (transport vs heat vs electricity). Similar patterns internationally?
- Not just demand reduction.
- Policy driven vs non-policy driven- do policy driven effects get under-mined? Or do they get locked-in? Different impacts of EU product standards? Impact of oil price falls?
- Energy efficiency improvements from installation of better home heating controls.
- What about existing work in this area, eg the IEA report on energy efficiencies around the world? Focus on what are the implications for the UK.
- What makes it a success? Transferability across countries/ cost efficiency of action/ proof of physical changes? (difficult to find lifetime quality documenting)
- When should other countries not copy the UK? Eg value of vernacular architecture.

- How do you decide appropriate comparator country: are very similar, able to implement changes, BUT radically different systems may enable truly new innovative ideas
- Be cautious re apparent 'successes'- may not be all they appear. Eg Swedish flats sometimes do not have an individual energy meter, so there is no price signal to reduce consumption. Not acceptable to switch systems, issues re: custom, method of collective negotiation energy prices/ rent.
- International myths- what are perceived to be the 'most important'? Examples.
- Researching international myths. Look at what the most important people in energy think is good or bad in other countries & research it.

5.3 Breakout group 3

Chair: Gordon MacKerron, University of Sussex and Chair, UKERC Research Committee
Note taker: Lindsay Wright, UKERC

Topics considered

- Impact of non-energy policies on the energy system
- Energy efficiency: claimed vs actual performance
- Acceleration of timescales for emissions reduction

Impact of non-energy policies on the energy system

- Interaction with people who study policy interactions.
- Policy areas that influence and impact on energy:
    - Transport
    - Planning (devolution/localism)

    - Localism
    - Education (eg timing of long holidays, school journeys to far flung schools etc)
    - Military
    - Health
    - Austerity
    - Privatisation/outsourcing (eg fleet transport, servicing). Consequences of privatisation/liberalisation agenda. This is huge – can it be mapped?
- Requirements on private buildings. Council house sell offs and tenancies, disincentives to energy efficiency. Who has the legal right to connect to heat networks, for example?
- Can we find examples of policies that have been transformative, at an urban/local scale, and make them visible?
- Reduction in meat consumption – measuring consequences. Other countries are now looking to emulate Western diets.
- Case for more regulation of energy efficiency?

Energy efficiency: claimed vs actual performance

- Get data and focus call so we don't get too wide a response.
- Get data on deterioration rates for period of installation. There is no deterioration agenda for buildings, no MOT for your house.
- Imperfect installation is an issue. Why is this a problem and how can it be obviated?
- What is energy efficiency? A reflection on the problem s of thinking about energy efficiency? No single metric against which you can measure improvement.
- Learning from overseas experiences. And from housing developments at different phases.

Acceleration of timescales for emissions reduction

- Can we look at examples of acceleration from other countries, and learn/draw comparisons?
- We need to identify the barriers and blocks for each scenario, and see what we can learn from them.
- Accelerating timescales – how do we drive take up?
- We need to look at both consumer and industry considerations.
- The challenge is the different rates of change for different technologies – eg PV versus nuclear – and how you build a system that is balanced.
- What are the roadblocks?
- How can legislation help?
- Could we have a project around planned (policy) versus unplanned (market) policies?
- You could also compare different actors' visions of smart systems. Expectations of timescales fro, eg telecoms? What does that mean going forward?

6 Appendix 3: background information on the key research areas

This background information on the ten research areas was sent to workshop participants in advance, and was prepared by the UKERC research co-ordination team.

Assessment of bioenergy with CCS (BECCS)

Bio-energy with carbon capture and storage (BECCS) plays a prominent role in many global and national future energy scenarios that could be

compatible with limiting average global temperature increases to 2 degrees. This raises a number of environmental, technical, social and other challenges. Some research is already underway or planned, for example within the UK CCS Research Centre (on the role of bioenergy CCS in integrated assessment models) and the first UKERC challenge consortium (on the implications of bioenergy CCS for natural capital). However issues such as accounting methodologies, innovation pathways, economics and policy implications have been relatively under-researched.

Electricity and energy storage

Storage is potentially very important for future energy systems. In our previous consultations, several areas were proposed that may be under-researched at present. Among these was the conditions for (and impacts of) the roll-out of storage technologies; the development of supply chains; and incentives and business models for storage; and the impact of storage on the energy system. Research in this area could have a strong spatial component, and could also focus on heat as well as electricity.

Discussions on this topic will need to take into account several new projects that have been commissioned in this area recently. There is also a second EPSRC challenge call for proposals. Examples of recently funded research the RESTLESS project (led by UCL, including policy and economic research at UCL and Birmingham), C-MADEnS (led by the University of Leeds) and MY-STORE (at Manchester).

Community engagement and energy systems

This area has been relatively well-researched over the past few years however the Research Committee and our wider consultations indicate that it may be worthwhile to pursue some additional research, particularly on the relationships between ownership, community benefits, engagement and public acceptance. Other possibilities include:

- research on the extent to which future energy technologies should require public support

- whether the lack of public support can hinder the development of a specific technology
- the effectiveness and impacts of the DECC Community Energy Strategy
- questions relating to the potential development of unconventional oil and gas

Implications of 'non-optimal' energy systems

This topic could include the implications of energy systems that are not as reliable or secure as current energy systems. It could, for example, explore the social acceptability of 'least worst' energy systems and the role of psychological trade-offs between the costs and any benefits of different levels of energy security. It could also include the development of methods and tools that could be alternatives or complements to least cost optimisation models. These could be used to explore non-optimal or 'second best' energy system transitions.

Linking research and practice for local energy systems

A variety of specific topics related to local energy systems have been suggested in our consultations so far, and some have been incorporated in to the first Research Fund call. Further research under this theme could include international comparisons of best practice in European cities, with an emphasis on learning from practitioner-led initiatives that are sometimes relatively disconnected from academic research. Other issues that could be explored relate to the effects of political leadership at a local level and how Local Authorities and other actors could support public involvement in local energy. Comparisons could be drawn between devolved administrations. This research could help to inform local decision-making about energy.

International comparison of efforts to reduce consumption

There is significant scope for comparative research in this theme, though any subsequent call in this area would need to take into account a fuller understanding of current and previous research that is already underway. It could also include review activity by the UKERC Technology & Policy

Assessment (TPA) Research Theme[2] to understand what the UK can learn from other countries in specific areas. A recent example of this is the TPA evidence review on household energy efficiency policies, which drew on an international evidence base.

Energy efficiency: claimed vs actual performance

Increasing attention is being paid to the discrepancy between the theoretical and the actual performance of different technologies, particularly in building design and more recently in transport due to the VW scandal. There is already a significant evidence base in some areas – though this is not comprehensive across all end use infrastructures, appliances and products. A more coordinated approach may also be needed in order to address these issues fully. A variety of disciplinary backgrounds and insights could be combined, including modelling, monitoring, validation and verification, and behavioural studies.

Impact of non-energy policies on the energy system

This topic would examine the implications for energy demand (and the wider energy system) of policy developments outside the energy domain. The implementation of non-energy policies can have wide reaching (and possibly unexpected) impacts beyond their initial target. For example, education policies have an impact on the daily life of many families. This, in turn, has an impact on daily and seasonal patterns of energy demand. The Research Committee has expressed significant interest in this research area. Any new research through the Research Fund would need to build on research already underway outside UKERC (most notably in the DEMAND research centre led by Lancaster). Any potential project would have to be well-bounded since a wide range of policy areas could be the focus for new research.

Acceleration of timescales for emissions reduction

Research on this topic would investigate the drivers of energy system change and the extent to which change can be accelerated. It could

[2] http://www.ukerc.ac.uk/programmes/technology-and-policy-assessment.html

include research on the timescales involved in innovation (which could build on a current UKERC TPA review on this topic[3]) and wider changes to energy systems and infrastructures. It could also include how changing social norms and trends (e.g. ageing and the development of medical technologies) could affect the speed of changes to energy systems. Other areas of research could include:

- a focus on the drivers of transport demand, and how these might affect the balance between different components of demand and transport modes
- 'locked in' emissions due to existing and committed infrastructure and the challenges of decommissioning existing infrastructure once it is no longer needed
- What socio-technical pathways are possible and what is the scope for transitions that involve rapid changes in supply and/or demand
- What lessons could be learned from innovation in other sectors and from historical energy transitions, particularly the extent to which these were 'controlled' and the extent to which they are cyclical

ICTs and energy system change

This is a very important area of energy systems research. Therefore there is considerable academic and industry research funded by ESRC, EPSRC and other funders – for example through Supergen hubs and challenges, TEDDI-net, infrastructure research centres and the Low Carbon Network Fund. Whilst it has been raised as a potential priority for UKERC in previous consultation processes, it is not clear if there is an obvious research gap in this area. Further consultation would be required to identify opportunities for further UKERC research.

[3] http://www.ukerc.ac.uk/programmes/technology-and-policy-assessment/innovation-timelines-from-invention-to-maturity-a-review-of-the-evidence-on-the-time-taken-for-new-technologies-to-reach-widespread-commercialisation.html

7 Appendix 4: list of attendees

Name	Institution
Alona Armstrong	University of Lancaster
Amanda Lea-Langton	University of Manchester
Astley Hastings	University of Aberdeen
Colin Axon	Brunel University
David Deller	University of East Anglia
David Joffe	CCC
Eldin Fahmy	Bristol University
Elizabeth Shove	Lancaster University
Estelle Rouhaud	London School of Economics
Jon Gibbins	The University of Edinburgh
Keith MacLean	ERP / Independent
Kevin Burchell	Policy Studies Institute
Marc Ozawa	University of Cambridge
Matthew Leach	University of Surrey
Mike Thompson	CCC
Nora Mzavanadze	University of Manchester
Padraig Lyons	Newcastle
Patricia Thornley	University of Manchester
Rick Greenough	De Montfort University
Robert Sansom	Imperial College London
Samuela Bassi	London School of Economics
Stan Shire	University of Warwick
Stuart Hazseldine	University of Edinburgh
Tadj Oreszczyn	UCL
Jon Saltmarsh	DECC
Neil Bateman	EPSRC
Ben Sovacool	University of Sussex
Hamish Elliot	DTD Limited
Troy Wrigley	Best Energy Saving
Carly McLachlan	University of Manchester
Rachel Macrorie	University of Sheffield
Gordon MacKerron	University of Sussex / UKERC

	Research Committee
Jim Watson	UKERC
Mike Weston	UKERC
Ioanna Ketsopoulou	UKERC
Lindsay Wright	UKERC
Amber Sharick	UKERC