DECC Science Advisory Group Meeting 1st June 2012

Meeting Minutes

Topics discussed

- Electricity Systems: the DECC "Summer Paper"[1]
- Implications of different generation mixes on the electricity system
- Technical and economic potential of different storage technologies
- Bioenergy strategy[2]

Present:	Apologies:
John Shepherd (Chair)	Paul Watkiss
David MacKay (DECC Chief Scientific Advisor)	Peter Cox
Nick Jenkins	Nicholas Pidgeon
Jon Gibbins	
Stuart Haszeldine	
Sue Ion	
Tadj Oreszczyn	
Chris Mottershead	
Harshal Mehta (DECC Evidence Team)	
Emma Devenport (CSA's Office)	
Rachel Crisp (DECC Electricity Markets & Networks)	
Damitha Adikaari (DECC Engineering Team)	
Phil Cohen (DECC Engineering Team)	
Anna Stephenson (DECC Engineering Team)	
Nafees Meah (Head of Science)	

[1] http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/future-elec-network/6099-elec-system-assess-future-chall-full.pdf
[2] http://www.decc.gov.uk/en/content/cms/meeting_energy/bioenergy/strategy/strategy.aspx

Introduction

Introduction by John Shepherd. No matters are outstanding from the March minutes, however Sue Ion's comments to be incorporated before finalising.

Action- Harshal Mehta and James Davey are to speak to the CSA and finalise the minutes.

CSA Report

The CSA gave an update on the following topics:

Success of the 2050 calculator – DFID have agreed to use their resources and help support calculator development in up to 10 other countries as well as China.

Bioenergy Strategy – The CSA has secured support from David Kennedy (Committee on Climate Change) and Bob Watson (DEFRA) for a proposal to improve government understanding of bioenergy issues. He thinks we need a bioenergy calculator allowing for the effects of land-use change, other greenhouse gases (e.g. N_2O) and emissions arising from production & transportation, instead of relying on the assumption that bioenergy is "zero carbon". This would help to determine the actual carbon fluxes, and changes in carbon stocks, occurring due to the use of biomass.

Climate Change Risk Assessment[3] – It is recognised that there are some weaknesses in the scientific basis of some parts of the assessment (e.g. correlations used to estimate crop yields). A more rigorous basis will be needed for future assessments. The benefits of solid wall insulation were probably also overestimated.

Nuclear R&D – GO-Science have put a good "PRAI" process (Plan for Research and Innovation) in place. A high-level Nuclear Research and Development and Advisory Board (NRDAB) , chaired by John Beddington, is meeting monthly to develop strategy and build a roadmap ,and a parallel Programme Board, chaired by Mark Higson, is going to make sure that decisions made by NRDAB are implemented.

RO banding – The RO banding team have taken on board feedback from David MacKay emphasising the greater value of dispatchable rather than intermittent electricity, and treatment of biomass, hydro and energy from waste, and the CSA now feels that the proposals on the table are improved.

Paper on impact of wind on carbon intensity of generation – Derek Pooley, (former Chief Scientist of the Department of Energy) sent the CSA a note giving top-down evidence (based on European data from 2009) suggesting wind renewables are not an effective way to reduce GHG emissions. This note lends support to the hypothesis that the whole-system knock-on effects of extra wind power are that the fossil fuel elements of electricity grid actually emit *more* carbon dioxide than they would have in the absence of wind generation. CSA

[3] http://www.defra.gov.uk/environment/climate/government/risk-assessment/

asked one of his engineers to look at this further. The engineering team have now done this, and identified serious concerns with the methodology used.

DECC priorities that the Science and Innovation Group is focussing on:

- Carbon Capture and Storage (CCS)
- Smart Meters, Controls and Demand-Side Response (DSR)
- 2050 engagement

Issues that the Science and Innovation Group are leading on:

- System Balancing
- Bioenergy
- Smart Thermostats
- Hydrogen

Presentation on the Electricity System – Rachel Crisp

DECC (Energy Markets & Networks team) will publish a paper on the electricity system over the summer[4]. The paper summarises the work underway to ensure the system is capable of meeting the challenges of a changing electricity market. It considers a number of questions including opportunities for technologies such as demand-side response (DSR), storage and interconnection. A whole system analysis was carried out to support this work.

The analysis is based on snapshots of 2050, 2040, 2030 and 2020. It makes an assessment of the balancing challenge and then considers system benefits for different technologies.

Based on the DECC Budget 2050 pathways, the analysis looks at four future potential pathways in 2040 and 2050, and a 2020 and 2030 central scenario.

- Pathway A: High Renewables
- Pathway B: High Nuclear
- Pathway C: High CCS
- Pathway D: Markal - varied generation mix

Key assumptions used throughout are that the UK is self-secure, and that there is 1:1 gas backup of wind (assuming a 3 day wind lull)

The analysis came to a number of high level conclusions:

- There is "value" of non-generation balancing technologies in all pathways.
- "Value" of the balancing technologies means a reduction in overall costs.
- The value of balancing options increases significantly beyond 2030 but is more marginal before 2030.

[4] Now published see: http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/future-elec-network/6099-elec-system-assess-future-chall-full.pdf

- The generation mix, increase and variation in demand are crucial factors when assessing the value of the balancing technologies.
- DSR and storage tend to compete for similar markets although the challenges of each technology are very different.
- Interconnection is particularly sensitive to the assumption that the UK is self secure and the degree to which DSR is used in Europe.
- Gas plants are still used as peaking plants in all pathways (most with high renewable, high electrification pathways and least when CCS is able to provide flexibility.)

Key sensitivities are overall demand for electricity (which is in part driven by the level of electrification of heat generation and of transport), the flexibility of DSR technology, and (for interconnection) the EU generation mix. No big threats were identified, but there are big opportunities for various smart technologies.

Comments
Rachel Crisp summarised that in the medium-term government needs to examine electricity system policy, however, in the short-term the DECC view is that new policy is not required. She highlighted a need for DECC to develop their work and identify areas that need to be explored further.

At present, carrying out detailed work on total systems costs & balancing is low priority. However, the CSA feels this should be top priority for DECC's new modeling team to work on. The SAG agreed with this and were keen for work to progress.

The CSA pointed out that the Innovation team are working hard to find new ways to reduce the cost of storage technology. Without a reduction in costs of storage, other technologies will be unable to compete with gas.

The SAG took a particular interest in emerging conclusions surrounding the high value of distributed storage i.e. homes installing batteries.

Stuart Haszeldine warned against the scenario where the UK is too dependent upon interconnections with France and Germany, as we are already short of storage.

Sue Ion recommended a paper by UKERC on interconnectors that maybe of use.

Jon Gibbins commented that the resilience of the system is crucially dependent on the high level of gas backup, and further runs with lower levels of backup were necessary.

Implications of different generation mixes on the electricity system – Nick Jenkins

Nick Jenkins presented on the implications of different future generation mixes in the UK. The information in the presentation was largely based around a report for the Energy Networks Association by Redpoint. It covers possible generation mix options between now and 2050.

The SAG concluded that a meta-study may be required to synthesise the multiple studies, and greater transparency w.r.t. assumptions, as it is difficult to draw firm conclusions from individual models.

Sue Ion and Chris Mottershead felt that the government should be setting out much clearer targets and try to achieve a national consensus for the future electricity mix, giving investors and the electricity market more guidance and confidence over technology directions for the UK.

The CSA stated that DECC's approach is to run technology competitions with the intention of eventually switching to an open market for low carbon electricity. He would like to see the public more engaged with the 2050 work in order to stimulate debate on these issues.

Chris Mottershead noted that a piecemeal approach is not enough and it is vital to have a policy structure with a 30 year time horizon that gives people confidence. Businesses may require more guidance and stronger price signals than the Carbon Plan provides, for example mechanisms that shape and influence the massive investments required from capital markets.

Sue Ion agreed that and lifetime-guaranteed investment incentives and a long-term energy plan with evolving expectations for the future generation mix is likely to be needed.

The CSA believes enormous incentives are being given, and that the Carbon Plan is an important piece in achieving the emission reductions committed to in the first four carbon budgets.

Action – Chris Mottershead is to share his thoughts on the government's approach to the electricity market with the CSA and Jonathan Brearley.

Presentation on real-time characteristics of a wind/nuclear/storage/controllable electricity mix - Jon Gibbins

Jon Gibbins presented an analysis that showed that as the proportion of installed wind capacity and inflexible baseload generation (e.g. nuclear power) increases in an electricity system the amount of surplus electricity also increases.

He stressed that surplus electricity is not free, since it has costs associated with producing it. He emphasised that any economic cost analysis of Electricity Storage should have the electricity cost as a component of operating expenditure and recommended this should be at the levelised cost of energy of the renewable source. The only alternative to this approach when levelised costs are being considered, if surplus electricity is considered to be available at zero cost, is to increase the levelised costs for the various generation sources to allow full cost recovery for these generation sources over the periods when electricity costs from them are assumed to be non-zero (i.e. the reported levelised cost for electricity from these sources will have to be increased). This latter approach is not recommended due to difficulties in estimating periods of surplus, although both approaches do meet the necessary criterion of having all the costs for generation allocated.

Action: Jon Gibbins is to convert his presentation into more connected written slides.

Electricity Storage

The CSA presented a summary of the Electricity Storage Technology Innovation Needs Assessment (TINA).

The conclusions from this suggest that:

- Pumped hydro has biggest short and long-term potential (for both power and energy).
- Compressed Air and Thermal-to-electric could offer benefits of a similar magnitude if these technologies can be commercialised and rolled-out.
- In the longer term, batteries have useful potential (and can feasibly be used at a *distributed* level).
- Flywheels and super-capacitors (according to the TINA) offer practically no potential in UK.

The CSA asked the SAG:

- Whether Compressed-Air Energy Storage (CAES) and thermal stores (which have high roundtrip efficiency) could be useful areas for UK innovation support?
- Should there be an innovation programme to reduce costs of storage? Is storage of excess electricity going to be useful?
- Are TINA findings using the right mix of storage technologies and is CAES the best?
- Whether they felt it would be reasonable to revise upward the potential CAES figures from 75GWh to about 1000GWh.

Action – SAG to provide the CSA with their views on these points.

Nick Jenkins pointed out that compressed air has been around for the last 15 years and has not been used. It will only be used if we have the correct technology. There are several time-scales of interest ((hours, days, and months), but the cycling cost is ultimately likely to be the dominant factor.

The SAG are concerned about the value and role of storage in the medium to long term. It is not clear whether a market yet exists (either centrally or at household level). However if the government is looking to stop wind spillage then some storage could be an economic option. They posed the following questions:

- Is the government prepared to make a strategic capital investment in development & deployment of storage technology?
- Is the framework for innovation set out in the TINA the correct one?
- Will storage be an economically sound investment? Are the cost estimates reliable, and is there more existing older data that could be exploited?

Action: The CSA is to discuss with Steven Fries (Chief Economist) the merits of holding a joint SAG / Economics Advisory Group meeting, what form such a meeting could take and what topics would be suitable for discussion.

Action: The CSA is to talk to Seamus Garvey about figures in the TINA relating to Pumped Storage vs. CAES.

Action: Harshal Mehta is to obtain storage history from past 10- 20 years from innovation team.

Action: Harshal Mehta is to obtain assumptions used on electricity storage costs in DECC Electricity System paper, and share with SAG members.

Action: John Shepherd is to contact Alison Wall (EPSRC) with regards to electricity storage research ongoing with EPSRC funding .

Heat Strategy

The SAG considered DECC's recently published Heat Strategy[5] and felt that it is technically sound and covered the key issues adequately and sensibly. The proposals made are pointed in the right direction.

Bioenergy Strategy

Anna Stephenson from the SIG engineering team gave a summary of DECC's Bio-energy Strategy[6]. The strategy sets out the government's approach to securing the benefits of bioenergy. It is the result of extensive analysis by a cross-government team.

The SAG were generally happy with the Strategy but made the following comments:

- Jon Gibbins considered that, if CCS technology were available, the best use of biofuels would be power generation with CCS as this would lead to negative emissions that could offset the use of fossil fuels in aviation more effectively than by using the equivalent amount of biomass-derived biofuels directly for aviation. If liquid fuels are in short supply (a long-term prospect) then Jon Gibbins mentioned the possibility of converting coal into aviation fuel (with technical advantages) and capturing CO2 from biomass using CCS rather than biomass conversion to liquid fuels.
- John Shepherd remarked that biomass is unlikely to become a major secure source of energy for the UK, as approximately 80% of biomass is imported.
- Stuart Haszeldine suggested that there is also the possibility of reforestation of some marginal land (subject to public acceptability).

Action: The SAG is to try and provide CSA with ideas about how production of low grade renewable heat (at perhaps 20 degrees Celsius) could be used (in

[5] http://www.decc.gov.uk/en/content/cms/meeting_energy/heat_strategy/heat_strategy.aspx
[6] http://www.decc.gov.uk/en/content/cms/meeting_energy/bioenergy/strategy/strategy.aspx

residential, commercial or industrial applications) to help meet renewable energy targets.

AOB

Janusz Bialek is a DECC/EPSRC Science Policy Fellow with the Evidence team for 6 months. He will be advising on electricity-system-modeling projects in DECC.

Tadj Oreszczyn mentioned concerns on Smart Meters Roll-Out risks, that the SAG should consider at a future meeting.

The CSA noted that at present his top seven list of issues were:

- CCS
- Smart meters & controls
- 2050 engagement (with influential stakeholders)
- System balancing
- Bioenergy and N_2O emissions
- Hydrogen (low-cost & low-carbon)
- Nuclear GDF process (selection & engagement)

Possible agenda for future SAG meetings

1. International Energy (Tech Gap, Conc. Solar, ERP analysis)
2. Discussion about Home Area Networks/Smart thermostats
3. Presentation on Smart meters
4. EMR (Capacity & Investment, Operational/Strategic)
5. CCS competition
6. Embedded carbon accounting
7. Biomass & Land-use change
8. Additional future agenda items

Meeting Closed at 17:00

ACTION SUMMARY

ACTION	OWNER
Finalise minutes from March	Harshal Mehta/James Davey
Provide views on • Whether Compressed-Air Energy Storage (CAES) and thermal stores (which have high roundtrip efficiency) could be useful areas for UK innovation support? • Should there be an innovation programme to reduce costs of storage? Is storage of excess electricity going to be useful? • Are TINA findings using the right mix of storage technologies and is CAES the best? • Whether it would be reasonable to revise upward the potential CAES figures from 75GWh to about 1000GWh.	All SAG
Slides into more connective written slides.	Jon Gibbins
Provide a reference to the "PRAI" process	David MacKay
paper by UKERC on interconnectors	Sue Ion
To provide SAG with estimates of potential costs of storage to 2050.	Harshal Mehta
Share thoughts on the government's approach to the electricity market with the CSA and Jonathan Brearley.	Chris Mottershead
Possible meeting between Science Advisory Group and Economics Advisory Group	David Mackay
CSA to talk to Seamus Garvey about figures in TINA	David Mackay
Alison Wall(EPRS) to provide information on energy storage.	John Shepherd
Presentation on Smart meters	Tadj Oreszczyn
Provide CSA with ideas about how production of low grade renewable heat (at perhaps 20 degrees Celsius) could be used (in residential, commercial or industrial applications)	All SAG