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Feedback on the Role and Importance of the Nuclear Academic Community

Dr David Clarke FREng, CEO Energy Technologies Institute

UK Nuclear Academics meeting, 14th September 2016

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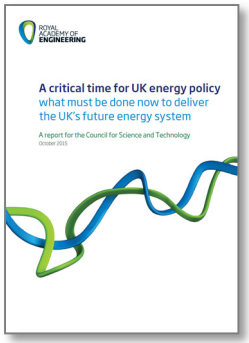
A critical time for UK energy policy

or "what must be done now to deliver the UK's future energy system ……"

- Royal Academy of Engineering report on behalf of the Prime Minister's Council for Science and Technology
- Built on previous work of the Academy on scale of the engineering challenge and need for whole-systems thinking to address the energy 'trilemma' - cost, security and decarbonisation
- Aim - offer insight for Ministers and officials into risks and uncertainties relating to delivery of the future UK energy system - particularly the engineering realities
- Timeframe - focused around 2030
- Report published October 2015 – conclusions still look relevant, potentially even more so !



Dr David Clarke FREng
Prof Nigel Gilbert FREng
Dr Martin Grant FREng
Dr Keith MacLean
Richard Taylor FREng

Dr Alan Walker
Dr Nick Hughes

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Sector's analytical consensus on the way forward is strong …..

As it is on the (massive) uncertainties ……

- Decarbonise electricity by 2030 – nuclear, CCS, wind and gas
- Then accelerate decarbonisation of heat & transport
- Retain centralised grids but 'smarter'

BUT …

- All working from the same assumptions and key data
- Failure recognised as 'not an option'
- Uncertainties are increasing
- Political will needed to deliver …..

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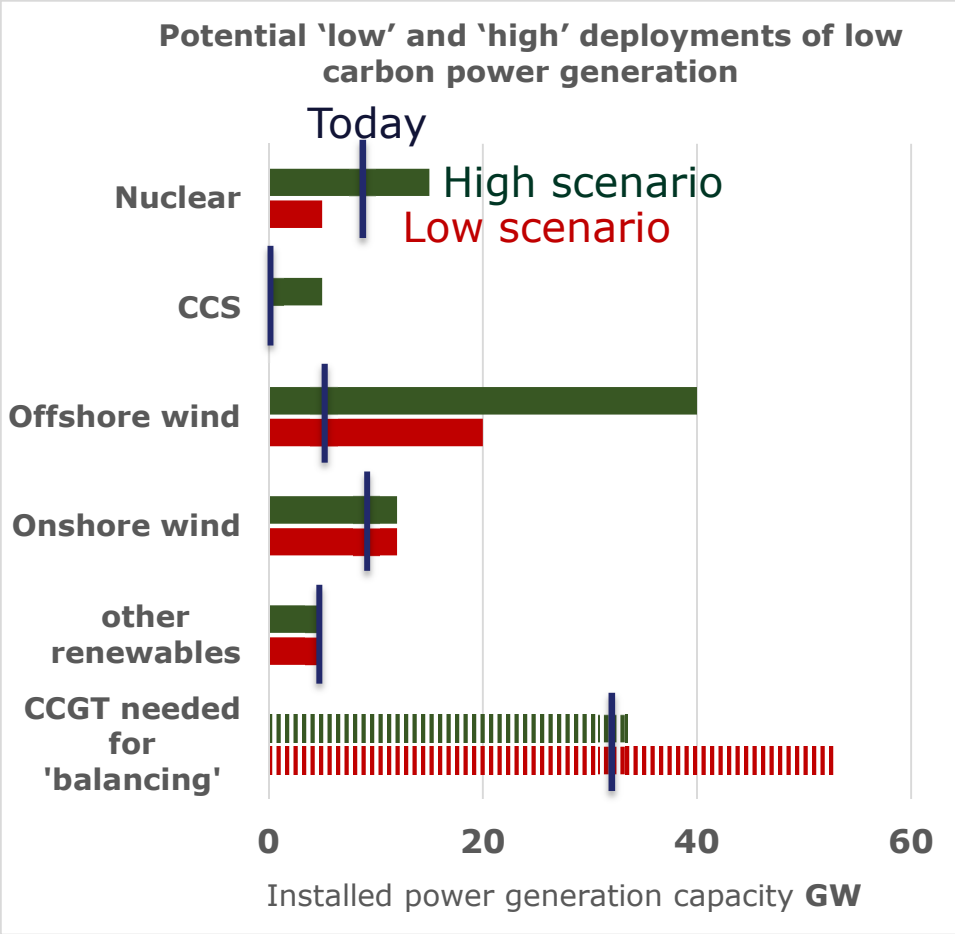
New infrastructure need is huge…

Irrespective of the exact low carbon solution



Modelling results grouped into 2 deployment scenarios

'low' and 'high'

–there is no perfect route

High deployment – 'heroic success'

Carbon **Security** **Cost**

Low deployment – 'all too difficult'

Carbon **Security** **Cost**

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Main conclusions were clear ….

there remain serious risks in the delivery of the optimal energy system for the UK, we should ….

1. Undertake local or regional whole-system, large-scale pilot projects to establish real-world examples of how the future system will work.

   These must move beyond current single technology demonstrations and incorporate all aspects of the energy system along with consumer behaviour and financial mechanisms.

2. Drive forward new capacity in the three main low carbon electricity generating technologies — nuclear, carbon capture and storage (CCS) and offshore wind.

3. Develop policies to accelerate demand reduction, especially in the domestic heat sector, and the introduction of ‘smarter’ demand management.

4. Clarify and stabilise market mechanisms and incentives in order to give industry the confidence to invest.

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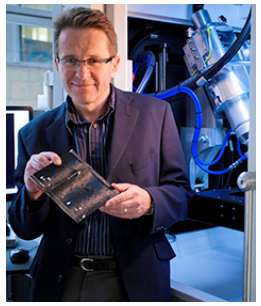
Beyond 2030 ….

Challenges remain

- Solutions require consideration NOW for ensuring impact from the full chain from research challenges to commercial deployment – involving multiple stakeholders
- Science, technology, engineering, finance, regulation, policy

Royal Academy of Engineering Business-University schemes



Industrial secondments

Enables outstanding early to mid career academic researchers to establish collaborative research partnerships with industry.

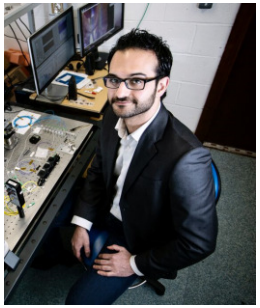
Research Chairs / Senior Research Fellowships

Co-sponsored by industry to develop 'use inspired' research programmes underpinned by world class basic research at UK universities.

Visiting Professors

Senior industry practitioners deliver face to face teaching and mentoring at universities to enhance student learning and employability.

Enterprise Hub



Harnesses the expertise, insight and networks of Academy Fellows to support the country's most promising engineering entrepreneurs.

Research Chairs / Senior Research Fellowships (SRFs)

Co-sponsored by industry to develop 'use inspire' research programmes

- Strengthens strategic partnerships between industry and academia
- Delivers use-inspired collaborative research that meets the needs of industry
- Supports academics to establish / enhance a world leading engineering research group

- 5 year award (~£225k over 5 yrs)
  (industry contributes at least £250k over 5 years)
- Currently 5 nuclear awards totalling >£1m from the Academy (of 48 total)
- Further 6 awards focused on other energy areas

http://www.raeng.org.uk/grants-and-prizes/support-for-research/research-chairs-and-senior-research-fellowships/research-chairs

Research Chairs / Senior Research Fellowships (SRFs)

Current Nuclear related awards

Dr Tom Scott (Senior Research Fellow)
Structural performance, ageing and corrosion behaviour of actinide materials

Professor Bruno Merk (Research Chair)
Validation and credibility of computational modelling for engineering, decommissioning and disposal

Professor Neil Hyatt (Research Chair)
Developing new techniques and understanding for dealing with radioactive waste materials

Professor Chris Pearce (Research Chair)
Extending nuclear plant life – modelling of fracture propagation and multi physics issues

Professor Ashraf Ayoub (Research Chair)
Structural engineering aspects of through-life aging

Prof Fionn Dunne (Research Chair)
Integrative mechanistic design

Dr Brian Connolly (Senior Research Fellow)
Corrosion performance of energy systems

http://www.raeng.org.uk/grants-and-prizes/support-for-research/research-chairs-and-senior-research-fellowships/research-chairs

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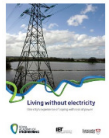
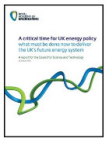
Royal Academy policy support ….

Some recent inputs on energy

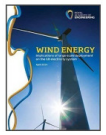


Living without electricity

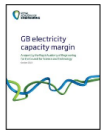


A critical time for UK energy policy

Innovation in energy



Wind energy: implications of large-scale deployment on the GB electricity system



GB Electricity capacity margin

Smart Meters

Environmental risks of fracking

Low Carbon Innovation: Energy and Climate Change Committee

Review of the Siting Process for a Geological Disposal Facility

Carbon capture storage

http://www.raeng.org.uk/publications

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Key issues for nuclear research

Recognised in 2015/16 EPSRC review of fission and fusion

Key challenge : maximising impact – short and long term

Fission

- UK research strategy hampered by lack of a clear national policy (multiple large reactor types, SMRs coming up on the rails, GenIV international programmes, ……)
- Community should seek to establish a strategy to manage through these uncertainties and to be ready to respond to national policy decisions
- Sustain leading activity in decommissioning and waste management
- Sustain work on plant life extension but consider who is best placed to pay for this

Fusion

- Exploit opportunities to apply leading capabilities in fusion materials and remote handling in fission (and non-nuclear applications)
- Progress JET + MAST-U but check progress and impact at 5 (JET) and 10 (MAST-U) years

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Time is critical ….

- The scale of the transformation required is huge, so decisions need to be made and actions sustained
- The big system decisions cannot be allowed to drift. The various options need to be tested and a sequence of deliverables defined.
- Decarbonisation of the electricity system is the immediate goal and actions need to be acted on immediately.
- In addition, by 2030, the country needs to be realising, or at least on a track for, wide-scale deployment of low carbon heating and transport.
- The design and testing of low carbon heating and transport solutions needs to start now, given the long lead-time (10 years or more) required for their development and commercialisation.

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some concluding sound bites

- " in developing energy policy, the whole system must always be considered "
- " what is required now is a combination of known technologies, scaled-up to unprecedented levels, integrated in smarter ways "
- " failure to work together by all stakeholders may be the single biggest risk for delivery of the future energy system "
- "The future is closer than it might seem ……"

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