

## DEBATE SUMMARY

### How can international research be mobilised to drive down the cost of renewables, storage and smart grids to achieve parity with coal fired electricity generation?

Held at The Royal Society on 8<sup>th</sup> July, 2015.

The Foundation is grateful to Atkins, the John Browne Charitable Trust, the Michael John Trust and the Royal Commission for the Exhibition of 1851 for supporting this debate.

The hash tag for this debate is #fstrenewables .

Audio files of the speeches are on [www.foundation.org.uk](http://www.foundation.org.uk) .

**Chair:** **The Earl of Selborne GBE FRS**  
Chairman, The Foundation for Science and Technology

**Speakers:** **Sir David King ScD FRS HonFREng**  
The Foreign Secretary's Special Representative for Climate Change, Foreign and Commonwealth Office  
**Dr Bernie Bulkin**  
Director, Ludgate Investments Limited and Former Chair, The Office for Renewable Energy Deployment, Department of Energy and Climate Change  
**Ed Heartney**  
Environment, Science, Technology and Health Counsellor, Embassy of the United States of America in London

**Panellist:** **Sir Colin Humphreys FREng FRS**  
Department of Materials Science, University of Cambridge

SIR DAVID KING said that the health, prosperity and energy security of our society were at risk from the effects of climate change. These risks covered a wide spectrum: from crop failure (for example of rice production in China) to sea level rise and river levels (for example in South East Asia). To cope with these and other risks, we had to reduce energy use from fossil fuels, and bring advice from the scientific, engineering and business communities into a coherent programme of action<sup>1</sup>. There was rising demand for energy, particularly in non-OECD countries, for example in Africa and Asia. Currently 49% of greenhouse gas emissions came from non-OECD countries and 51% from others. Dependence on fossil fuels should be reduced as soon as possible, and already action was being taken at technical as well as political levels. But huge problems remained, among them reducing the unit cost of supply of renewable and nuclear sources. A particular problem was how better to store energy and the use of smart grids to respond to peak demand.

Governments and industry should support a voluntary ten year programme laying out targets with appropriate roadmaps and means of efficient

management at all levels, global as well as local. Establishing a Commission alongside The International Energy Agency in Paris would ensure that such a programme was well managed. The complexities were not always understood, and the technologies required would have to cope with off-grid villages, and towns and countries covering a wide variety of time scales and circumstances. There was already much interest in such a programme in G7 and other countries, and the sooner something was put in place the better, in particular before the climate change conference in Paris in December. Already the G7 countries were committed to decarbonize the global economy, but they had yet to show how it was to be done.

DR BULKIN showed a short film<sup>2</sup> to illustrate the scope of the problem. Somehow we had to look after our only home – the Earth – whose health was threatened in a number of ways. He would focus first on the processes of industrialization, and the technologies now under development, in particular renewable energies, electronics and storage. Unit costs of supply were falling, in particular of solar energy, but a lot depended on how such technologies were applied and where. The same was true of wind power, preferably off-shore, and

<sup>1</sup> Sir David King together with the Lords Browne, Layard, O'Donnell, Rees, Stern and Turner have set out in a report entitled 'A global Apollo programme to combat climate change' proposals for an international commission to co-ordinate a programme to drive down the costs of renewables, storage and smart grids:  
[http://cep.lse.ac.uk/pubs/download/special/Global\\_Apollo\\_Programme\\_Report.pdf](http://cep.lse.ac.uk/pubs/download/special/Global_Apollo_Programme_Report.pdf)

<sup>2</sup> What's Possible: a film directed by Louise Schwartzberg  
<https://youtu.be/G4r50sKyTUU>

tidal power. Exploitation of biomass was likewise promising, together with some but not all other technologies discussed in the Apollo report. We had to consider methods of renewable cooling as well as of renewable heating. Likewise there was progress on storage of energy where costs again had been much reduced, and could be reduced further. New batteries were not the only option. Use of such materials as graphene had great promise. Reactions to all this had been mixed. Some still resisted renewables and argued against carbon capture and storage. We now needed to establish carbon prices globally and so far as was possible establish common technologies. There was every opportunity for putting together a properly funded global programme, and in the meantime to counter the absurdities of hostile propaganda.

ED HEARTNEY said that society faced a difficult transition from dependence on traditional technologies for its energy to something new which emitted less carbon. Current greenhouse gas emissions were still rising, but with increasing use and investment in the alternatives there was real progress in slowing the upward trend. The United States was still dependent on coal, gas and oil, but the current Administration was committed to action to promote renewables (as well brought out in the recent agreement between the United States and China). Although there was nothing comparable in the United States to the British Climate Change Act, which targets carbon dioxide emission reduction, action at State level was real in cooperation with business and industry. There was also effective cooperation with such other countries as Canada, increasing deployment of smart grids to increase energy efficiency, and a big US Government programme on energy storage and other technologies. The United States was committed to action with the aim of establishing cost parity of renewable and fossil fuel energy generation.

SIR COLIN HUMPHREYS opened the debate. Assessment of long-term levelised costs of renewable options was critical to the development of future energy policy. In the UK the strike price for gas fuelled electricity generation is £39 per MWh, £92.5 per MWh for nuclear, £120 per MWh for solar, £95 for onshore wind and £155 per MWh for offshore wind. Solar is costly not because of the cost of the PV panels but because of the cost of leasing the land on which to place the panels. To balance the electrical supply development of innovative storage and smart grid systems were essential. UK peak electricity demand could occur on a cold winter night when a high pressure zone with low wind speeds and darkness limits solar

supply. In such circumstances drawing on storage is essential. Currently this is from pumped storage hydro-electric schemes. The challenge of managing renewables were one of the reasons why the world was still so dependent on conventional power. There should also be more research into demand management. The substitution of conventional light bulbs by LEDs is leading to a substantial reduction in energy demand for lighting. He believed that the funding for research into renewables, storage and smart grids should be increased.

In subsequent debate there was emphasis on the challenges of scaling up renewable options, storage and smart grids. Above all we needed political will to address these challenges, The greatest challenge was to develop energy storage technologies at scale at an acceptable cost. As was recognized in the "Global Apollo programme to combat climate change" report, we had to secure political commitment to a co-ordinated programme with sufficient resources in support. Germany already had a competitive edge after making substantial investments in electricity generation from renewables. Even geothermal energy was looking good in some places. Political will was essential in judging the risks involved, and the Apollo Programme pointed in the right direction. Already the development programmes were advanced in some places such as the United States and China. We had to look again on what should be subsidized and for how long, and to encourage cooperation, even collaboration, as well as competition between the technologies and all involved.

There were also practical issues to consider such as material selection for offshore wind to extend the life of structures, gearboxes and blades in the harsh corrosive offshore environment. Carbon capture and storage projects were underway but the cost penalty for such systems made it unlikely that schemes would be widely adopted. Gas fired electricity generation produced the lowest carbon dioxide emissions per MWh of generation and could provide an alternative to coal fired generation while renewable technology was developed. Currently solar requires 4 to 6 acres per MW of generation capacity. Research in Oxford on novel materials such as Perovskites has shown significant efficiency gains in the conversion of solar radiation to power.

In summing up the debate the EARL of SELBORNE said that it had brought out how much innovative thinking was required and the need for action at all levels of society.

Sir Crispin Tickell GCMG KCVO

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A global Apollo programme to combat climate change  
Centre for Economic Performance, London School of Economics and Politics  
[http://cep.lse.ac.uk/pubs/download/special/Global Apollo Programme Report.pdf](http://cep.lse.ac.uk/pubs/download/special/Global%20Apollo%20Programme%20Report.pdf)

Atkins  
[www.atkinsglobal.com/en-gb](http://www.atkinsglobal.com/en-gb)

Carbon Trust  
[www.carbontrust.com](http://www.carbontrust.com)

Committee on Climate Change  
[www.theccc.org.uk](http://www.theccc.org.uk)

The Department of Energy and Climate Change  
[www.gov.uk/government/organisations/department-of-energy-climate-change](http://www.gov.uk/government/organisations/department-of-energy-climate-change)

The Department for Environment, Food and Rural Affairs  
[www.gov.uk/government/organisations/department-for-environment-food-rural-affairs](http://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs)

Economic and Social Research Council  
[www.esrc.ac.uk](http://www.esrc.ac.uk)

Engineering and Physical Sciences Research Council  
[www.epsrc.ac.uk](http://www.epsrc.ac.uk)

The Environment Agency  
[www.gov.uk/government/organisations/environment-agency](http://www.gov.uk/government/organisations/environment-agency)

Innovate UK  
[www.gov.uk/government/organisations/innovate-uk](http://www.gov.uk/government/organisations/innovate-uk)

Natural Environment Research Council  
[www.nerc.ac.uk](http://www.nerc.ac.uk)

Oxford Energy, University of Oxford  
[www.energy.ox.ac.uk/solar/](http://www.energy.ox.ac.uk/solar/)

The Royal Academy of Engineering  
[www.raeng.org.uk](http://www.raeng.org.uk)

The Royal Commission for the Exhibition of 1851  
[www.royalcommission1851.org](http://www.royalcommission1851.org)

The Royal Society  
[www.royalsociety.org](http://www.royalsociety.org)

Science and Technology Facilities Council  
[www.stfc.ac.uk](http://www.stfc.ac.uk)

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