

DEBATE SUMMARY

The economics of decarbonisation of the UK electricity supply –
how much are we prepared to pay to meet carbon reduction targets?

Held at The Royal Society on 27th November, 2013

The Foundation is grateful to the Technology Strategy Board for supporting this debate.

The hash tag for this debate is #fstdecarbonisation .

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

Speakers: **James Smith CBE**
Chairman, the Carbon Trust
 Dr David Clarke FREng
Chief Executive, The Energy Technologies Institute
 Baroness Verma
Parliamentary Under-Secretary
Department for Energy and Climate Change

JAMES SMITH said that delivering reductions of global carbon intensity to zero by 2100 was not a question of lack of technologies, nor of affordability (1% of UK GDP) but of time constraints and lack of determined leadership.

Globally we must move from the current 0.7% p.a. reduction to 6%; getting to 10% by 2050. We could do it economically if we phased decisions on total system costs; overcame the inertia in the system and took phased "option management" approaches to technological deployment, keeping all options open while assessing every technology on its costs on the whole system; would the whole system be less costly if this technology were used?

System costs must take into account seasonal variations, peak hour loading, safety (for nuclear) and back up for renewables. But assessing system costs is not easy; every country will have different factors to consider; data is uncertain and modelling is complex. All policies should go for diversity. But whatever we do, and however fast renewables grow, we will still rely heavily on the use of fossil fuels. The Energy Bill sets the right framework for developing a market based on phases of technological demonstration, maturing development in some specific areas, technology neutral auctions and, finally, technologies mature enough, with a high

carbon price to allow full competition. But all this needs to be explained to the public; the systems approach to be followed; knowledgeable teams kept together in DECC, and commercial incentives simplified.

DR CLARKE endorsed James Smith's emphasis on a systems approach, and the need for urgent action. He reviewed likely growth in demand for energy use in transport, for heat as well as for electricity; the increase in fuel poverty; the ageing UK infrastructure and the eternal tension between sustainability, security and affordability.

We need to pay at least 1% of GDP to meet carbon reduction targets and unless we optimise the system it will be 2%. We will (as James Smith said) need to rely on fossil fuels - coal - and that means developing effective Carbon Capture and Sequestration (CCS) systems. We must have consumer support for inevitable increases and acceptance of the use of all technologies (not ban some as in Germany and Japan) and create incentives for investment.

Six areas where asset replacements would benefit total system costs and be technically and financially feasible were, nuclear, offshore renewable, energy efficiency, gas, bioenergy and CCS. But the difference by 2050 between a "no targets" regime and a -80% Carbon reduction target for the

different sources of fuel for electricity generation was great; although by 2020 it was minimal. CCS and nuclear were crucial and we must decide now to prepare the infrastructure to meet the timetable. After 2020 it will be too late; costs will rise and we will not be able to meet 2050 targets. Failure to use any technology, or optimise costs will take the additional cost over 1% of GDP.

In summary we needed from now to 2025 to prepare consumers and industry for the new energy regime; (£5bn pa); from 2025 to 2040 to build it (£15bn pa) and thereafter plan, maintain and operate new systems (£35bn pa). Key challenges were in devising good business models, ensuring investment confidence and driving down cost. Innovation was key but so was consistency, and rollout of new technology. We needed several new nuclear stations; CCS commercialisation (led by DECC programmes) and then major pipeline, storage, disposal and other investments. But without consumer understanding and acceptance of our policies, we will fail.

BARONESS VERMA said that the Energy Bill provided the opportunity for government and industry to work together to develop the substantial increase in generating capacity that was necessary in a cost effective carbon reduction environment. The Contracts for Difference (CFD) provisions would allow cost-effective technologies to be developed and rolled out as innovation brought further cost reductions and technical problems were solved.

The new regime was estimated to reduce energy prices by 9% over what would have been necessary under the previous regime. By developing new technologies we will also create new employment opportunities, enhance skills, and create opportunities for entering global markets. Indeed, if new technologies do not lead to global opportunities, it is unlikely that they will be successful in the UK.

We will also give confidence to investors about the returns they can expect from new technologies. Collaboration with other government departments (BIS), industry and academia was vital, but innovation could be spurred by the government. The DECC innovation unit (which the NAO had praised) were working to develop CCS commercialisation projects at Drax and Peterhead. Her aim was to build partnerships with companies and others

which will, in time, allow full competition in the market for a choice of technologies. She entirely agreed with James Smith and Dr Clarke that it was essential to prepare and plan now for future non carbon developments.

Speakers in the following discussion challenged the assumption that consumers would be willing to accept the cost of the carbon targets - even if it was as low as 1% of GDP. Although presenters had stressed the need for carbon reduction, and warned of the dangers of increasing emissions, this was not a message which the public understood as meaning that they must suffer now.

The public understanding of risk had always been shallow. There was, of course, the problem of fuel poverty, to which the government had produced no answer, but there was the more underlying problem that global warming was not seen as a crisis, when people would respond to demands for action, but as something which might happen in the future.

The media demonised any price increases deemed to be "green" and the Prime Minister seemed himself less certain about the green agenda. Why then should the public believe in the importance of carbon reduction targets? It should be true that innovation will reduce costs, and green technologies provide UK industry with opportunities for global sales. We already cooperated with Chinese scientists and had industrial relations with China. It should also provide for more jobs (although there had been no analysis of where the jobs would actually be - would they for example reduce unemployment in cities such as Newcastle).

The euphoria that some years ago accompanied environmental concern, when Lord Stern's report had been published had now evaporated. Too much emphasis had been put on the cost of energy technologies, not on the price that people would have to pay. Was the price solely to be met by the consumer, would there be further government subsidy from the taxpayer; how could rewards to energy companies be minimized?

While great emphasis had been put on supply issues, there had been little discussion of the demand side. If prices were to rise, much greater efforts need to be made to encourage consumers to restrain their demand. A full rollout of smart meters would help, particularly to moderate peak demands and

unnecessary use of power. But it was behavioural change in consumers' attitudes that was needed. There were insufficient incentives on retailers and other business consumers to reduce energy use. Education was key, but we should not underestimate community pressure (as had happened with waste collection). Communities could come together to promote demand reduction, and to make consumers feel guilty if energy was wasted.

Speakers questioned whether all sources of energy generation had been considered - such as geothermal, marine technology and storage. The modelling that had been done, did take account of all these sources but, in considering what were the practicable and cost effective sources available within the timeframe, they had ruled these sources out as too expensive and with technologies still insufficiently developed.

Onshore wind had also been excluded - there was not much more land available for it and its output was uncertain. The analyses done showed how important CCS was, with the ability to develop multihued sources and the production of hydrogen as a valuable fuel source in itself. But we must recognize that energy companies do not like it (complexity of a chemical plant attached to a generator, and diminished output), nor do environmentalists (still a fossil fuel).

If the large investments which were necessary were to be financed, the cost of capital needed further examination and any suggestion, such as those of Ed Milliband, that energy prices be capped, would damage investment confidence. It was possible that only very large multi-national companies or national funds would be able to finance the costs. Existing energy companies were

unlikely to have sufficiently large balance sheets to do so. Thought ought to be given to enabling them to raise further equity, possibly from consumers, for carbon reduction technologies.

There was concern that the EU were seeking to impose a target for renewables, which was inconsistent with the UK governments belief that one should be technologically neutral amongst technologies, to ensure system optimisation. There were problems about setting particular target dates for any technology - for example offshore wind could benefit from bigger and better turbine design if the target was later than, say 2030.

The key to cost effective carbon reduction was flexibility and diversity amongst fuel sources. The price of individual fuels such as gas will vary significantly and cost changes mean that some technologies become less or more cost effective. Generators need to be able to shut down plants which become uneconomic and switch resources quickly to other technologies. Demand is more stable, but we need to be clearer how, in the long-term, we are to manage it.

Principal messages from the discussion were that, although the presenters had made it clear how a cost effective carbon reduction policy could be implemented, there were a number of obstacles to be overcome before we could assume it would be implemented. First, was the need to convince the public that we needed to do it at all; second, it would be expensive and consumers would have to pay more; third, assurance that the regime was stable so that investors could understand the incentives and rely on assured income streams; and fourth, that demand had to be tackled more aggressively.

Sir Geoffrey Chipperfield KCB

TED Talk:

Professor David MacKay, Chief Scientific Adviser, Department of Energy and Climate Change
www.ted.com/talks/david_mackay_a_reality_check_on_renewables.html

Useful Links:

Carbon Trust
www.carbontrust.com

Department for Energy and Climate Change
www.gov.uk/government/organisations/department-of-energy-climate-change

The Energy Technologies Institute
www.eti.co.uk

Engineering and Physical Sciences Research Council
www.epsrc.ac.uk

European Climate Foundation: Roadmap 2050
www.roadmap2050.eu

Fraunhofer-Institute for Solar Energy Systems (ISE)
www.ise.fraunhofer.de/de/presse-und-medien/presseinformationen/presseinformationen-2013/was-kostet-die-umwandlung-von-erneuerbaren-energien-in-strom

The Foundation for Science and Technology
www.foundation.org.uk

Global Energy Assessment
www.iiasa.ac.at/web/home/research/Flagship-Projects/Global-Energy-Assessment/Home-GEA.en.html

Natural Environment Research Council
www.nerc.ac.uk

The Royal Society
www.royalsociety.org

Science and Technology Facilities Council
www.stfc.ac.uk

The Technology Strategy Board
www.innovateuk.org

The UK Energy Research Centre: Presenting the Future
www.ukerc.ac.uk/support/article3514-Are-we-getting-better-at-predicting-future-electricity-generation-costs

US Energy: the New Reality
www.chathamhouse.org/publications/papers/view/191405

World Energy Council: Cost of Energy Technologies
www.worldenergy.org/publications/2013/world-energy-perspective-cost-of-energy-technologies

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