



Sir Joseph
Swan Centre
for energy research



Sir Joseph Swan Centre

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To: EMR-condoc@decc.gsi.gov

Dear sir/madam,

Re: Electricity Market Reform consultation

I am responding to the above consultation on behalf of the Sir Joseph Swan Centre for Energy Research at Newcastle University. The Sir Joseph Swan Centre for Energy Research (SWAN) is an interdisciplinary research institute within Newcastle University. It provides the focus for energy related research across the University and incorporates researchers from eleven academic schools. SWAN's mission is to provide an intellectual lead in the pursuit of the low-carbon economy of the future, by developing new technologies which reconcile human needs for energy conversion and use with social and ecological needs. Formed in 2007, SWAN now has about 100 members whose expertise reaches into most of the disciplines of relevance to clean and renewable energy, providing an extensive academic and industrial contact base around the world.

Current Market Arrangements

1. Do you agree with the Government's assessment of the ability of the current market to support the investment in low-carbon generation needed to meet environmental targets?

The current electricity market was set up to deliver low prices to consumers in the short term. It provides no mechanism for accruing funding for future investments, especially investments in leading-edge technology which require an element of external financial support. The preamble to the consultation document refers to the need to strike a balance between the best possible deal for consumers and providing the certainty that investors need. That is a manufactured conflict. It is not a good deal to provide consumers with cheap electricity from a system that is doomed to collapse. The real challenge is to establish a sustainable electricity price – one that supports necessary reinvestment consistent with the level of security that we are prepared to pay for. There is a debate about what proportion the consumer should pay and what proportion the taxpayer should pay, but there is not a conflict with investor interests.

What investors actually need is clarity concerning the fiscal regime, regulatory regime and any incentive mechanism that pertains to their prospective investment – and they need that clarity to extend at least to the point in time where they plan to have recouped their investment. All the usual market risks remain, but they need to be sheltered from government-generated risk. Once they have that level of certainty, they make their investment decisions and live with them. This is especially important in respect of offshore wind Round 3 and the transposition of the Renewable Energy Directive into UK law.

2. Do you agree with the Government's assessment of the future risks to the UK's security of electricity supplies?

The risk to the UK's future electricity supplies is significant. However, we think that there is a risk of "sleepwalking into an all-electric society" without actually making a conscious evidence-based decision that this is the correct thing to do. It has long been understood that heat is a very low-grade form of energy and electricity is a very high-grade form of energy, which is why using electricity for heating is both rare and



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expensive. This is taught in schools and universities all over the country. There is an ongoing debate about the extent to which electric vehicles will replace internal combustion engine vehicles running on liquid fuels, and about the timescale over which that will occur. There is little sign of consensus. The jury is still out on whether the UK will wholeheartedly embrace biofuels as a low-carbon liquid transport fuel for internal combustion engine vehicles. The UK lags far behind other European countries in the deployment of Combined Heat and Power technology.

The reality is that the UK's CO₂ emissions today are split roughly equally between electricity generation, heat supply and transport fuels (all forms). While all of the critical issues listed above remain unresolved, this consultation makes the sweeping assumption that we should want to electrify heat and transport – simply because we can, and even if we cannot afford it. It is self-evident that if Government makes the assumption that it is right to electrify everything, then the risk of failing to supply future electricity “needs” is high. This is a big assumption upon which to build a consultation exercise.

Turning to a different subject, the world will continue to burn fossil fuels for many decades to come – hopefully using CCS technology. The UK has huge untapped coal resources – about 70 billion tonnes – most of which is unmineable. There is technology under development which allows this coal to be gasified *in situ* (viz. without mining it) and then use the resulting synthesis gas for power generation in conjunction with CCS. I would refer you to a recent article in the Royal Academy of Engineering's publication *Ingenia*:

- Younger PL, Gluyas J, Cox M and Roddy DJ, Underground Coal Gasification, *Ingenia*, Royal Academy of Engineering, June 2010

At the current UK coal consumption rate of 40 million tonnes per year, that coal resource could represent over 1,000 years of supply.

As a final point on this question, we consider that there is a lot of ill-informed debate on the subject of how much backup is required to wind electricity generation. If you are looking for a sound scientific treatment of the subject, I would recommend the following two papers from the peer-reviewed literature:

- Gerber A, Ekanayake JB and Jenkins N (2010), Statistics of wind power output: methods and applications, Proceedings of the institution of Civil Engineers, Energy 163(4): 183 - 193
- Gross R, Heptonstall P, Leach M, et al. (2007), Renewables and the grid: understanding intermittency, Proceedings of the institution of Civil Engineers, Energy 160(1): 31-41.

In conclusion, whilst we might dispute some of the assumptions that lie behind this consultation document, we agree that there is a serious problem with future risks to the UK's security of electricity supplies.

Feed-in Tariffs

8. What impact do you think the different models of FITs will have on the availability of finance for low-carbon electricity generation investments from both new investors and the existing investor base?

The Stern report made it very clear that there is a very real cost of CO₂ emissions. If governments around the world were to levy that charge on all CO₂ emissions, the markets would swing into action and solve the problem, however brutally. But that is not going to happen, so the best we can get is a succession of stop-gap measures that electorates are prepared to tolerate. That makes for gross investor uncertainty. The real question, therefore, is not whether one support mechanism is slightly superior to another, but which one we are prepared to stick with through thick and thin after it has been implemented. It goes without saying that those investors who have already invested under a previous support mechanism must be protected from any adverse change – otherwise we set a precedent that will discourage all future investment.



Emissions Performance Standards

12. Do you agree with the Government's assessment of the impact of an emission performance standard on the decarbonisation of the electricity sector and on security of supply risk?

Yes.

13. Which option do you consider most appropriate for the level of the EPS? What considerations should the Government take into account in designing derogations for projects forming part of the UK or EU demonstration programme?

The current UK grid average figure is 560 g CO₂ /kWh. A level set at 600 g CO₂ /kWh would be too high and would send the wrong signal. UK and EU approved CCS demonstration projects (of the type currently under discussion) should be exempt. They are being judged on a different basis against multiple agendas.

14. Do you agree that the EPS should be aimed at new plant, and 'grandfathered' at the point of consent? How should the Government determine the economic life of a power station for the purposes of grandfathering?

Yes. Yes. The grandfathering arrangement should not extend to the whole economic life of the power station. If a power station is designed to last (say) 25 years, and is expected to end up running for (say) 40 years with appropriate asset-life extension projects, and investors are expecting to have recouped their investment (according to the business plan) after (say) 10 years, then the grandfathering arrangement should last for 10 years.

18. Do you agree the principle of exceptions to the EPS in the event of long-term or short-term energy shortfalls?

The restriction on annual emissions should be absolute. That provides operational flexibility without undermining assumptions made by other investors.



Options for Market Efficiency and Security of Supply

19. Do you agree with our assessment of the pros and cons of introducing a capacity mechanism?

The key point is that there needs to be a sound basis for any decision on how much emergency capacity or backup capacity is actually needed. This has been partly addressed already in our response to Q.2. I would also refer you to another excellent paper in the peer-reviewed literature which takes a rigorous look at the subject:

- Gerber A, Awad B, Ekanayake JB and Jenkins N (2011), Operation of the 2030 GB power generation system, Proceedings of the institution of Civil Engineers, Energy 164(1): 25 - 37

This paper takes a rigorous mathematical approach to optimising the UK's power generation system in the context of the targets that have been set for 2030. It takes as its starting point the target set by the Climate Change Committee to reduce the carbon intensity of grid electricity from 560 gCO₂/kWh today to 70 gCO₂/kWh in 2030. They go on to identify a generation mix for 2030 which achieves that figure as an annualised target. Not surprisingly, it contains a large proportion of offshore wind, onshore wind, nuclear, tidal barrage, coal with CCS and gas with CCS. It examines the need for spinning reserve for wind. They then formulate a constrained optimisation problem for unit commitment and optimum dispatch – looking at the two most extreme weeks of the year on a half-hourly basis. It is interesting to see quantitative conclusions concerning the optimal amount of demand management and the optimal amount of wind energy curtailment required under extreme circumstances as well as the CO₂ prices that are required in order for the 2030 targets to be hit under operational conditions. Whilst others might approach it slightly differently, this shows the level of rigour that ought to be expected ahead of putting an expensive mechanism in place.

Implementation Issues

30. What do you think are the main implementation risks for the Government's preferred package? Are these risks different for the other packages being considered?

The Government appears to have identified the main risks that could undermine a smooth transition to a new system or undermine investor confidence. The problems will arise in the details that have not been considered yet. Sound, informed, impartial advice is the best defence against that.

34. Do you agree with the Government's assessment of the risks of delays to planned investments while the preferred package is implemented?

This is always underestimated, as we have seen many times when moving from one system to another.

37. Some technologies are not currently grandfathered under the RO. If the Government chooses not to grandfather some or all of these technologies, should we:

Covered earlier.

[REDACTED]

[REDACTED]

[REDACTED]

