



HOUSE OF LORDS

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The Select Committee on Science and Technology

Inquiry on

THE RESILIENCE OF ELECTRICITY INFRASTRUCTURE

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Witnesses: Dr Robert Gross, Rupert Darwall and Dr John Constable

USE OF THE TRANSCRIPT

This is a corrected transcript of evidence taken in public and webcast on
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Members present

Earl of Selborne (Chairman)
 Lord Broers (co-opted)
 Lord Dixon-Smith
 Lord Hennessy of Nympsfield
 Baroness Hilton of Eggardon
 Baroness Manningham-Buller
 Lord O'Neill of Clackmannan
 Lord Patel
 Lord Peston
 Lord Rees of Ludlow
 Viscount Ridley
 Baroness Sharp of Guildford
 Lord Wade of Chorlton
 Lord Willis of Knaresborough
 Lord Winston

Examination of Witnesses

Dr Robert Gross, Reader in Energy Policy and Technology, Imperial College London, **Rupert Darwall**, Author of REFORM publication *How to Run a Country: Energy Policy and the Return of the State*, and **Dr John Constable**, Director, Renewable Energy Foundation

Q167 The Chairman: Good morning. Welcome to this meeting of the Select Committee. We are grateful to our three witnesses for providing oral evidence to us today as we are coming to the conclusion of our inquiry into electricity resilience. We are being broadcast, so I will ask you first for the record to introduce yourselves, and if any of you want to make a short opening statement, do please feel free to do so. Perhaps we could start with Dr Robert Gross.

Dr Robert Gross: Good morning. Thanks very much for the opportunity to be here. Very briefly, I am an academic. I run a research centre at Imperial College. I am one of the directors of the UK Energy Research Centre. Among my research interests is the production of reports based upon systematic reviews—meta-analysis—of the available evidence. I have led reviews on the costs of intermittency, and what we think we know about the costs of technologies in the future and why we often get that wrong. I have also been a specialist adviser to the Select Committee on Energy and Climate Change, looking at its scrutiny of the draft legislation for EMR—electricity market reform. I have also spent a lot of my career looking at innovation, and looking at the outline questions that I have been sent by the clerk I imagine that is why I am here.

Rupert Darwall: My name is Rupert Darwall. I produced a policy analysis and review of the evolution of electricity market policy for REFORM late last year, and I am the author of a book on global warming.

In my opening statement I would like to offer your Committee four thoughts, if I may. The first is that the question of the desirability of decarbonisation as a policy objective is separate from the means of achieving that objective and the specific means that you are examining: the policy of supporting renewables.

The second is that if you subsidise high-fixed-cost, zero-marginal-cost intermittent electricity generation, you will end up destroying the market and incentives to invest in the capacity to keep the lights on when the wind is not blowing and the sun is not shining. That outcome was wholly predictable but wholly unanticipated by policymakers, at least in the White Papers and various public policy papers.

The third is that as a result the Government have been forced to take back control of electricity generation. We have therefore ended up with a structurally unsound hybrid of state control and private ownership. We incur the higher costs of private finance but we do not get the benefits of market allocation and capital.

The fourth—and this in reality is a fundamental choice that policymakers shy away from—is that you can have the market, you can have renewables, but you cannot have both.

Dr John Constable: Thank you very much for the invitation to give evidence. I am John Constable. I am director of the data and analysis publishing charity, the Renewable Energy Foundation, and we have long been concerned—indeed, since our creation in 2004—with the implications for system security and the cost-effectiveness of an overly rapid adoption of uncontrollably variable renewables. Indeed, in 2008 we published a major analysis, written with the well known energy analyst Hugh Sharman, in which we predicted the current generation capacity difficulties and their implications for system security and consumers, for many of the reasons which Mr Darwall has referred to. If that sounds rather like, “We told you so”, I am afraid it is meant to.

Q168 The Chairman: Thank you very much. I am conscious that some of our questions are going to be rather general and the temptation to wax at length is going to be great, but I hope that we can keep it fairly short and sharp so that we can cover as much of the ground as possible. Having said that, I must ask a fairly general question to begin with, which is of course that the coalition Government, early in their term of office, adopted EMR—electricity market reform—which some would say has brought back large-scale government intervention, which, of course, was previously reduced by the privatisation some years ago. Do you think that the present EMR policies strike the right balance between a market-led approach and government intervention? Who would like to start?

Rupert Darwall: My answer to that is no. There is in effect no balance to be struck. On your characterisation of EMR, I think the Government themselves characterised it as the Government taking control of the electricity-generating sector, and they do not foresee a return to the market until 2028. Indeed, they believe that there will be three five-year plans to get us back to a market. I think there is a fundamental problem with the Government specifying the type of generating technology that there should be, and in particular subsidising a form of generation that, for reasons that we can go into, destroys the ability of investors of dispatchable capacity to have any form of predictable returns on their investment. So there is no balance to be struck. The choice is: do you have a market or do you have renewables?

The Chairman: Dr Gross, would you like come in on this?

Dr Robert Gross: I kind of agree and disagree. EMR is interventionist, and it seeks to bring about a transformation of the energy system. If we were not concerned about climate change, we would not have EMR. The system that we had before EMR was introduced was doing okay in terms of the efficient use of fossil-fuel power stations. We had a problem in that we were prematurely closing a bunch of coal-fired power stations and the market was not responding quickly enough to that problem, but we did not need EMR in its entirety to solve that problem, and I do not think that we needed EMR in order to meet our 2020 targets for renewables either, because we already had the renewables obligation, which could have been extended and made to work to meet the 2020 targets for renewables. So I think we should be clear that one of the reasons why we have EMR is that the Government decided that they did not just want to build renewables, they also wanted to build new nuclear power stations, and they did not have an environment that made that possible for investors because those nuclear power stations were exposed to too much wholesale power price risk and volatility over the long term, so the Government created many of the structures around EMR in order to allow those nuclear power stations to come into existence. We can discuss whether or not that was a desirable thing to do, but I think we have to be very clear that if we want to transform the energy system to radically decarbonise it in a relatively short space of time, we cannot do that based on the system that we have now. We can discuss whether EMR is a kind of halfway house and whether it was a kind of reregulation by stealth. If you look at the history of policy ideas in this country, you can see that it kind of is. We kind of could not admit in 2008 or 2009 that what we really wanted to do was tell the energy sector what was required of it, so we ended up with this halfway house. The question, pragmatically, having spent several years getting on with this legislation in place, is whether it can be made to work, not whether we can tear it up and start again as if we had never done any of that. I think we probably could if we got the political commitment that is required in order to make that happen. I will stop there.

The Chairman: Would Dr Constable like to add anything?

Dr John Constable: Yes, I certainly would. The key character of EMR is given away by a single term in some of the EMR documentation. The first, “administrative pricing”, indicates a very significant intervention into the electricity market, and if you doubt that, Mr Davey, Secretary of State, wrote in the *Guardian* quite recently actually using those words; he describes it as a very significant intervention in the system. He was, in fact, rebutting an editorial calling for even more. Why did the Government choose to extend their interventions? As Dr Gross quite correctly says, the Renewables Obligation was already there. Well, this is distressed policy correction. Having so damaged the market with distortions such as the Obligation, they found themselves in the absurd position of having to provide counter-subsidies to encourage investment in other technologies. This is a perfectly foreseeable sort of outcome from the market distortion which Mr Darwall has already referred to.

Q169 Viscount Ridley: The focus of our inquiry is energy resilience. Is what Dr Gross was saying correct: that decarbonisation comes at the expense of resilience, that it cannot not come at the expense of resilience, that we can do something to improve resilience after that but we are bound to make resilience worse? This slightly goes to the question of intermittency, which we will come to later. Are decarbonisation and resilience opposites? Are they orthogonal?

Dr Robert Gross: I can see no particular reason why they are. I can see that we will have a conversation—

Viscount Ridley: Because dispatchable power is not there when the sun does not shine or the wind does not blow.

Dr Robert Gross: I think it depends on the mix of technologies that you put into the market. If you want to radically decarbonise the energy system, you need to have CCS, nuclear, or renewables, or some combination thereof. You need to have a system that is different and in some respects more difficult than just having flexible fossil-fired power stations that you can ramp up and down in order to meet demand, but I do not think that it is in any way inevitable—and there has been an awful lot of work internationally—that you end up with a system that is less resilient as a result. If fossil fuel prices are low, you probably end up with a system that is more costly as a result, but I do not think it means that it is less resilient.

Lord Dixon-Smith: Chairman, I apologise to the Committee if I am wasting its time, but I want to ask a question that should have been asked six or seven years ago. Is the fundamental policy of reducing our carbon emissions by 2% a year—because we have to reduce it by 80% over 40 years—appropriate? My own view has always been that rushing into green technologies when we do not know anything about the competitive position of doing so is exceedingly rash, and I think we have been driven by this policy when it might have been more sensible simply to look at getting the generating capacity that we need at the best cost and taking a bit more time to learn about how we could actually decarbonise the system. I think we are driving through on the basis of a fundamental policy flaw.

Rupert Darwall: Could I respond to that? If you look at the history, the fateful date in this episode was the spring 2007 European Council at which Tony Blair committed Britain to the most demanding renewables target in the EU. Before that, the Government's policy was, if you like, coherent and rational: to rely principally on the EU's emissions trading scheme. That was a market-based approach that would have enabled competing technologies to demonstrate and reveal which were the most efficient at generating electricity at the lowest possible cost. But after that point, once the renewables target had been established the rest of it fell away and there has been this huge push into driving a technology that has very destructive impacts on other generators.

Q170 Lord Broers: Dr Gross, from what I heard you say, EMR was introduced mainly to find a means of financing nuclear. I had naively thought that it was to cope with the intermittency of weather-based renewables.

Dr Robert Gross: I think you need to look at the different components of EMR. I think the most significant shift that the EMR package of measures introduces—we can talk about the capacity mechanism, which I believe we are going to come back to—is long-run, fixed-price contracts for all forms of low-carbon generation. In the case of nuclear that means that you can enter into a fixed-price contract for, I think, 40 years. I do not think we should see EMR as being introduced in order to make up for the limitations and shortcomings of weather-based renewables; I do not think that was its principal requirement. Lots of electricity jurisdictions around the world have capacity mechanisms. We can have a more or less academic conversation about whether or not we can allow the market to function in the absence of a capacity mechanism, whether scarcity and so on will signal the need to build new power stations and whether policymakers wish to rely on that or whether that in itself

imposes price spikes and so on, and whether security is an externality, and so on, but I disagree that the most significant component of the EMR package is the capacity mechanism. I think that the most significant component of it is the contracts for difference.

Lord Hennessy of Nympsfield: I was intrigued by a passage in the mini-biography of you that we have. You argue that, “Just as engineering R&D may be measured in terms of patents or improvements to products, so policy research may be measured through improvements to policy and policy thinking”. Many of our witnesses—and Mr Darwall already today—have been pretty critical about successive Governments’ ability when it comes to energy White Papers and thinking ahead. It is as if Whitehall and successive Ministers lack the divine spark ever to get a grip on this problem. Energy supply is a perpetual problem for every Government. It is one of the first requirements of the state, yet many witnesses, and I think you this morning too, have suggested that there may be something inherent in the difficulties of energy policy review that means that all this looks so unsatisfactory in retrospect—or is that an unkind judgment on past Governments?

Dr Robert Gross: At the risk perhaps of straying too far into the philosophical, I do think that there is a collective gestalt—a collective mindset—of the day. If you look at when EMR was first considered, there was Project Discover, which Ofgem ran, and then a subsequent Green Paper, that began to worry about these issues. I think many of us thought at the time that we would probably introduce something like a low-carbon obligation that was a bit like the renewables obligation with tradable certificates but extended to include nuclear and CCS. But internationally at that time we saw that feed-in tariffs—fixed-price contracts for renewables—had been extremely effective at bringing renewables to market around the world, and that they were delivering renewables more cheaply because they derisked more effectively for various categories of prospective investor than the rather complicated system that we had in the renewables obligation. At the same time, we wanted to create an incentive scheme for nuclear that did not look quite like a subsidy so that we could try to get it through the state-aid scrutiny process.

I am not apologising on behalf of the Government for all these things, I am just observing, as someone who has been involved as an academic and as an adviser to Governments and Select Committees looking at how these events unfolded, that one can kind of see how we have ended up where we are. The biggest difficulty with where we are in practical terms is that we have tried to derisk by creating technocratic derisking in the form of the contracts for difference, but we do not have the political support across the piece. In particular, we do not appear to have the support of the Treasury that allows that legislation if you like to be given a chance to work, because if we are trying to do something over a 15-year period out to 2030 but we have no clarity whatever about what we are going to be doing after 2021, and if investors are already perceiving this to be contested within the Government’s own ranks, you cannot expect the cost of borrowed capital to come down. Cock-up rather than conspiracy would be my analysis.

The Chairman: I will ask Lord Rees to ask his question next, and then I will ask Lord Broers to move us on.

Lord Rees of Ludlow: A question really for Mr Darwell. You extolled in your pamphlet the move away from state towards the market post-1990. How do you feel that has worked in the nuclear industry, because as I see it we have lost a great capability in the nuclear industry, and if we have nuclear power stations in the future they will be state-owned by the

French state or the Chinese state, which seems perhaps to be an unfortunate outcome of post-1990 policies? I would like to ask you to comment on that.

Rupert Darwall: I think, Lord Rees, that you are absolutely correct in saying that the market did not want to finance nuclear power, and that is simply because the process of privatisation revealed the horrible economic record of Britain's civil nuclear programme, which was a financial disaster. It is very difficult to find anywhere around the world where the market has financed nuclear power without any state support. That is an example. If you want nuclear power, in some way or another you will want the state. I personally think that privatisation was a huge benefit in revealing the very poor economics of nuclear power.

Q171 Lord Broers: Are sufficient steps being taken by the government regulator and National Grid to ensure the resilience of the electricity system? Are National Grid's new balancing services likely to be sufficient to balance supply and demand over the next two winters? Will the capacity market be effective at balancing supply and demand in the medium term? Is there a risk that too much capacity will be supported and the cost to consumers too high? Finally, does the capacity market provide sufficient promotion for measures such as demand-side response and interconnectors? If not, how could this be addressed? A lot of questions, I am afraid.

The Chairman: I do not know whether Dr Constable would like to address the question.

Dr John Constable: I will take up the last question about the demand-side response. I have noticed a worrying tendency to regard demand-side response as a long-term planning measure. That is, I think, imprudent. Demand-side response is really a last resort. It is a short-term, operational measure, and the consequences of allowing it to drive the market are likely to be unfortunate. A thought experiment may help: suppose you are a capital investor thinking of deploying capital in the United Kingdom. You obviously have options elsewhere—you have the option of building your factory in an economy where demand is allowed to command supply. On the other hand you might put it in the UK where apparently supply is going to be allowed to regulate your demand. Where are you going to put your money? Even if you are rewarded with some kind of generous payments under a demand-side response system, you may well wish to remain in the driving seat. Liberty is not perhaps so easily obtained that you should want to surrender it for mere cash payments.

With regard to interconnectors, I think the case for them is greatly overstated. We published extensive work concerning the performance of the interconnections between Denmark and the European network: the UCTE system. The work was conducted for us by Paul-Frederik Bach, who was planning director for Eltra and therefore responsible for managing wind power. His conclusions were that although interconnectors were very valuable economically—trading was generally a very good idea—the role of interconnection in supporting wind could be greatly overstated and that you should not take the full capacities of the interconnectors at face value. When the system is under stress, the interconnection will tend to be reduced, for very good reasons. I do not think that is now particularly controversial; it is referred to in a recent study for DECC by Mott MacDonald—a document called *Technical Measures for the Mitigation of Electricity Imbalance Risk*, which I am not sure is published, although it is certainly in circulation. Mr Henney, I think, mentioned it in evidence to this Committee. If you do not have it, I would be very happy to submit it, as I happen to have a copy and I think it would be of use to you. It refers at some length to the limits for interconnection, and I think it would be valuable for you to read it.

Lord Broers: The interconnection capacity is quite small anyway, is it not?

Dr John Constable: Relatively small.

Lord Broers: Do you think we should increase that capacity, or is it just not going to be a winner anyway?

Dr John Constable: I would be very much in favour of further interconnection for electricity trading, but I would not expect it to be particularly valuable in managing the uncontrolled variability of large renewable fleets in the UK. It would have to be justified on other grounds.

Lord Broers: So it is very unlikely to be very windy in Denmark when it is calm here.

Dr John Constable: Work, again conducted by us in 2008 and now by others, looking at the synchronisation of weather systems over northern Europe shows that similar weather conditions tend to prevail over very large geographical areas.

The Chairman: Would either Dr Gross or Mr Darwall like to refer to National Grid's new balancing services and tell us your confidence in that delivery?

Dr Robert Gross: I am very happy to do so. To be frank, I do not think there is an awful lot else that we can do in the short term. We absolutely have to overcome a situation where margins are tight and at the same time plants are mothballed. That cannot possibly be in the public interest. I think we need to be clear about the source of the problem, which is that we have prematurely closed a bunch of perfectly serviceable old coal-fired power stations for reasons to do with environmental concerns other than climate change, and that either the ability of the market to provide new capacity quickly enough or the ability of policymakers to anticipate this problem and put new policy measures to oblige the market to provide capacity quickly enough failed to deliver. We are in the situation that we are in, and to the best of my judgment National Grid is doing what it can to make sure that we do not have power cuts—blackouts, to use a tabloid phrase—over the next couple of years before new generation begins to come on stream and the situation begins to ease. This is not a problem caused by renewables; it is a problem caused by EMR to the extent to which when you say that you might have to have a capacity mechanism you damn well have to have a capacity mechanism. It becomes a self-fulfilling policy, so it is a policy problem in that regard—"We said we were going to have one, but we did not get one quickly enough".

It does make me cross when I read press reports that we are returning to energy rationing. Energy geeks for as long as I can remember have been fascinated by the idea of smart demand-side response and so on, because generally speaking the demand side does not do anything in the electricity market. Economists like the idea of markets where all the participants are able to participate fully in the activities of the market, and I see no difficulty or problem at all in an undertaking of any form, a company of whatever form, that signs an interruptable contract, gets cheaper power as a result, and probably will not get its supplies interrupted but is prepared to do so in extremis if called upon to do so—and a whole range of other cleverer things that we might be able to do on the demand side in the future, but they are not relevant to this particular conversation.

Q172 Lord Wade of Chorlton: Obviously I understand your concerns and criticisms, and I have a lot of sympathy with them, to put it bluntly. But what policy should we adopt to try to improve the situation? What proposals can you make as an alternative to what we have? How do we get out of it?

Dr Robert Gross: I do not think we can do anything other than what we are doing over the next two years, because too much time delay is involved in bringing new capacity to market. I think it is extremely unlikely that we will have power cuts. National Grid may need to call upon some of the interruptible services and do other things in order to ensure that we get through this period of tight margins. Beyond that, you had some very eloquent evidence from David Newbery that I read in the transcript about the functionality or otherwise of the capacity mechanism. I very much think that we can debate the longer term, the 2020s, decarbonisation, nuclear versus CCS, and all the rest of it, but I really do think that having just got these policies into place and with all this apparatus around the capacity mechanism, we need to give that a chance to work to make sure that the system stays reliable.

Viscount Ridley: At the risk of sowing a little discord between you, I understood Dr Robert Gross to say that the fact that we are mothballing gas stations at a time when capacity is getting tight, as it were, is not a problem that is caused by renewables, but is not the issue what Mr Darwall said: that if I am the owner of a gas power station, I have to take into account the fact that I am up against a competitor with zero marginal cost, so I cannot be guaranteed to be able to have the customer for my electricity all the time and I therefore have to switch off when the wind blows, which destroys the economics of my entire operation? Is that not the issue, where renewables and the capacity mechanism come together?

Rupert Darwall: I respectfully disagree with Dr Gross on this. If you look at the EMR policy papers, Chris Hume used to say that the big problem was the “missing money” problem. The “missing money” problem is caused by intermittent renewables, so the EMR was set out to address that problem. In the US, one of the effects of renewables, and you have identified this problem, has been that a nuclear power station is going to be closed prematurely. If you believe in decarbonisation, that has to be the most senseless outcome you can imagine. Nuclear power stations have very, very high sunk costs at the beginning and the end of their lives. When they run they cost virtually nothing, but the impact of renewables has been to put a huge question mark over nuclear power stations in the United States.

If you step back and look at the bigger issue, Dr Gross has talked about the political risk as if it is being generated from within government and from within the Treasury. The political risk is what you read in the newspapers, and that is voters complaining about higher electricity prices and political parties in a democracy competing for votes. You have one political party saying, “We are going to freeze energy prices. We are going to regulate energy prices”, and all that is a big sign to investors of the growing political risk of investing in the UK generating market. It is that aspect of political risk that is a fundamental problem with EMR in this halfway house, in that the Government are saying what technologies they want investors to put their money into and at the same time are asking investors to manage and price political risk which the Government’s policies are creating. In my view, that is fundamentally unsustainable.

Dr Robert Gross: I would just like to make a couple of points in response to that. The first is that the “missing money” problem has been discussed in energy economics over an extended period of time, and long before we had even the slightest sense that we might be able to make the progress with renewables that we have made.

Viscount Ridley: Could I have a quick definition of the “missing money” problem?

Dr Robert Gross: The “missing money” problem is that prices will not spike high enough for you to make the scarcity rents that you need in order to invest in a new asset. That is the heart of it. I am very happy to give supplementary evidence on that if that would be helpful.

Can I just also make the point that if we were having the conversation about Germany, we could legitimately talk about the current capacity of renewables having significant impacts on the profitability of conventional generating stations? We are nowhere near that position in the UK at the current time.

Viscount Ridley: We are hoping to get there.

Dr Robert Gross: We are hoping to get there, but we should not misconstrue the problems that we face over the next couple of years. Those problems result primarily from policy and investment decisions that were made in the mid to late 2000s for a number of reasons, such as failing to act swiftly enough to make up for the shortfall in the closure of the coal-fired power stations. I do not think those decisions and judgments were being made because of EMR, because EMR was not even a twinkle in the eye, and that we were going to move to this world of such deep penetrations of renewables that you would not be able to recover the investments that you made in a gas-fired power station.

Dr John Constable: Can I comment on the “missing money” problem? The coal stations closed because of the Large Combustion Plant Directive, but capacity failed to come forward because the future market, even under the renewables obligation, was likely to be much smaller and much more volatile. Therefore the load factor for an investor in a gas turbine was going to be very low, it was going to be very difficult for them to recover their fixed cost, and there was an insufficiently strong price signal for them to want to build combined cycle gas turbines. That was true under the Renewables Obligation, quite regardless of the EMR. Indeed in some respects, as I have already said, the EMR is an attempt to restore some kind of price signal for investors in firm capacity. It has the additional benefit from the Treasury’s point of view, of course, of putting some kind of limit on the cost of the scheme after 2020; the Renewables Obligation was clearly running away.

Lord Willis of Knaresborough: I often have a discussion about missing money with my wife, so this is a new look at it. I would like to take you back to Lord Broers’ early question about the new balancing services which the Government and the suppliers have brought in for the next two years to ensure that we have a balanced system. Are we simply adding more complications to the system by these new devices? Would we not do better to try to increase the margins well above 4% or 6% to somewhere around 10%, as Dieter Helm suggested in his evidence to us?

Dr Robert Gross: If we allowed the generation market to make more profit rather than it not making very much profit, and then the utilities—

Lord Willis of Knaresborough: We are aiming to have a balance at around 4% of supply over demand. If we increased that to around 10%, as Dieter Helm suggested, we would not need the sorts of balancing services that have been brought in for the next couple of years.

Dr Robert Gross: I think that would be a rather risky approach. National Grid ultimately, as the system operator, has the responsibility to take actions in the balancing market and ultimately to use various direct contracts that it has with generators, and to a lesser extent with the demand side, to ensure that demand meets supply instantaneously at every moment. I have come from an engineering-based university and perhaps I am biased in this

regard, but it seems to me that if you are worried that the public interest will not be served by the electricity market because of various failings, whether policy or market—and whose fault they are we can discuss—extending the ability of the system operator to contract for new services and in extremis to require companies to make capacity available is a better way of providing a safety net in difficult times than hoping that if we allow them to make more profit, that might happen by itself.

Dr John Constable: I think you are actually asking whether derogations would be offered to plant that is currently being retired under the Large Combustion Plant Directive rather than about the economics of it, were you not?

Lord Willis of Knaresborough: Yes.

Dr John Constable: That would be very embarrassing, to say the least, and perhaps not feasible. You have to remember that this plant has been expecting retire, so it has been run down. Whether it could be granted a prolonged lifetime is open to question, but it would certainly require some kind of breach of the large combustion plant directive, and I suspect that would be very controversial.

Q173 Lord Peston: I would like to take us on to costs and that sort of thing, but before I ask the specific things that I have in mind, I must say that I very much agree with Rupert Darwall that the industrial structure that we now have in this sector is totally irrational, and with all due respect to Dr Gross I do not think there is the slightest chance that it would enable us to get an optimal outcome, however you define “optimal”. Let me also add that taking a sceptical view of decarbonisation was never an available option in our country, or indeed in most other countries, to any of the political parties at all, so we have to go ahead on the basis of a positive response to decarbonisation, and therefore we have to look at what it costs us. I take it that we all agree with that. The economics of then looking at the costs at the theoretical level is incredibly easy: you do it by discounted cash flow. I take it that you agree that that is how we have to take these decisions. The problem is how you calculate the costs in practice rather than in theory. In particular, surely a great deal of the problem revolves around what discount rate we use in comparing the different flows of capital and current costs and returns. Do you have a view on the correct discount rate? As you know, there is a massive economic literature now right across the spectrum for the answer that it ought to be nought right through to the answer that it should be a very high number. What is your view?

Rupert Darwall: You have put your finger on a very important question. Essentially, the Government are specifying what generating technologies should be invested in. The public sector has a cost of capital that is quite low. The private sector has a higher cost of capital because it is at risk, and when we look at electricity and higher electricity prices they layer political risk on top of that. So in my view an important thing to look at is the cost of capital of various arrangements. In the last days of the last Labour Government—I think it was in March 2010—there was a joint DECC-HMT assessment that looked at which structure for the industry would generate the lowest cost of capital. As part of the justification for the EMR the Coalition Government looked at the switch from a renewables obligation to CfDs and they got some economists to look at the gain from the reduction in the cost of capital. That reduction in the cost of capital under the EMR is a fraction of what you would get if the state paid for what it mandated. So my prime beef with the current arrangements is that if the Government want the generating sector to look at a particular way, if they want renewables,

the best thing to do is to get out their chequebook and pay for it. That is the lowest-cost outcome for the economy as a whole.

Lord Peston: Sorry, I do not understand that. I mean, the cost should not depend on who is financing it. The cost is a real economic phenomenon.

Rupert Darwall: The supply of finance will depend on who is providing the finance. If you are using state finance, it will cost less than if you are using—

Lord Peston: Yes, but I thought that economists had long since abandoned that position. Of course the state can borrow more cheaply than the private sector, but that does not mean that the state should therefore finance something. I thought that we had abandoned that in economics donkey's years ago.

Rupert Darwall: It is because the private sector's higher cost of capital is offset by greater private sector capital allocation efficiency, and we have lost the benefit of the market allocating capital—we have the state allocating capital. In theory, the cost of capital is the asset, but in this particular example it has been aggravated because you have the whole question of political risk, and private investors have to price in political risk for all the reasons that Dr Gross has talked about and that we read in the newspapers. Investors will be concerned that the policy arrangements underpinning their returns will not be continued because they result in too high prices, at some point the policy framework will change and in a sense their returns will be expropriated. So they have to price in a higher cost of capital. That is just a fact of life.

Dr Robert Gross: I actually agree with an awful lot of what Rupert is saying about this. What we might have done had we approached this rather differently right from the beginning is say, "Well, a nuclear power station or a large offshore wind farm is an asset". It is a big like the National Grid, and we allow the National Grid to operate as a monopoly with a regulated return on investment, which means that it is attractive to certain categories of investor risk categorisation, which generally means that like most regulated asset base utilities it can borrow money more cheaply than the traditionally competitive market for fossil-fueled power stations. I remember Dieter Helm writing a very interesting paper—since he has been mentioned—suggesting that we might have done just that. It is a step short of doing it through public finance but it might be able to realise much lower costs of capital, and because these things are so capital-intensive, as you rightly say the discount rate is of immense importance to this. We have not gone down that particular road; we have gone for a kind of halfway house, which, as I have said, seemed as though it ought to work at the time, and it was what was acceptable to the mindset, if you like, of the Treasury economist at the time. If it turns out to be an unmitigated disaster and we are not accessing cheaper money, then obviously we need to think again. But we have scarcely got this through the statute books; it has had very little time to—

Lord Peston: Can we finish off on this? Are we able to answer the simplest and most naive question—namely, what does a typical onshore wind farm cost in capital terms and what does a typical nuclear power station cost? Going back to my younger days as a junior economist in the Treasury, we always knew that a nuclear power station would cost at least twice what the advocates claimed—a typical Treasury view, I agree. In fact, it usually turned out to be four times what the advocates wanted.

The Chairman: The attempt at privatisation proved that, did it not?

Lord Peston: Do we have any hard data, so that those of us outside could work on it and take a view?

Dr Robert Gross: I would be very happy to send you data on capital and costs—

Lord Peston: So you definitely have that and you would live and die by it.

Dr Robert Gross: I would not live and die by it, although I would live and die by it on the costs of building wind farms. There is a very large global market for wind farms, so we have a good idea how much it costs to build a wind farm. We have a much less good idea about how much it would cost to build a nuclear power station in this country. Frankly, we really do not know how much it will cost to do carbon capture and storage—CCS—which I am rather enthusiastic about and think we should do more on.

Lord Peston: Do we have any idea about costs for building a tidal barrier?

Dr Robert Gross: We have estimates of how much it would cost.

Rupert Darwall: Can I just follow up on that? You have put your finger on an incredibly important deficiency in EMR, in my view, which is the very poor accountability. A great volume of spending is being financed by consumers and not by the Treasury, so there is very little data—we do not know what that spending is procuring. I find that a very big worry, because in this halfway house—this ill defined no man's land between the private and public sectors—we do not know as much about what is going on as we would if it were within the public sector, where there is traditional public sector accountability.

Viscount Ridley: We know the cost of a wind farm today, but do we know whether it is going to come down in future? We have heard very divergent views in the inquiry between people who think that the cost of renewables, particularly solar, is going to come down and those who have said that the cost of wind might not come down so much. What are your views on that?

Dr Robert Gross: I have done an awful lot of work on this. What we can say is that the cost of onshore wind came down steadily through the 1990s and early 2000s and then plateaued. There is some evidence that there will be a return to cost reduction in onshore wind but probably nothing like the scale of cost reduction that we saw in the early period, when we were realising economies of scale and so on. It is also important to be clear that movements in markets—movements in the competitive position of how many manufacturers there are and all these kinds of things—can influence prices just as much as learning affects an innovation and getting better at technologies. If I had to make a projection, I would say that we could expect a return to modest cost reduction in onshore wind. I think there is the potential for a considerable and dramatic cost reduction in offshore wind, but not if we go charging after it and do it all wrong, which is what we have been doing up till now.

Lord Broers: I have another quick follow-up to that. None of these wind farms has been running for very long. Are you equally confident about the maintenance costs of these things for 20 years?

Dr Robert Gross: We have been operating wind farms since the early 1990s.

Lord Broers: Yes, but a lot of those are extremely unreliable. You can drive by them and see at least one-third of the turbines stopped. Are you sure about the maintenance costs?

Dr Robert Gross: I am not a wind farm operations and maintenance engineer, but I know that we are able to make an advanced gas turbine with all the stresses and all the issues that that involves and we are able to make incredibly reliable motor car engines, so I cannot think of any conceivable reason why great big companies like Siemens, GE and the rest of them that make wind turbines would not be able to make them operate reliably.

Lord Broers: But for a while they could not. It was only Bosch and some other German companies that came in about five or six years ago with gear boxes that they would guarantee for 20 years. These gear boxes are transmitting power unlike any other gear box in the world and they have to be placed on top of 300-foot towers, so if they go wrong it is not easy to crane them out and replace them.

The Chairman: Let us park that one, because I am not sure that we are going to get an answer on the long-term maintenance costs. If there is any further evidence that anyone can send us on that, we would be grateful.

Q174 Lord O'Neill of Clackmannan: Part of what we are concerned about in resilience terms is intermittency. What would you regard as the options for overcoming this intermittency? The ones that we have already had posited are flexible generation, interconnection, storage and demand-side response. Would you take much comfort from these options as alternatives or as anchors for resilience?

Rupert Darwall: I cannot give you a technical answer, but what I can suggest on renewables is that, while we have been discussing the maintenance costs of wind farms and whether they have been falling, of course there is a whole dimension that that debate tends to miss out, which are the costs that they impose on the rest of the system—the grid costs—and on other forms of generation. That is essentially what we are discussing this morning. One solution to that problem is for wind generation to internalise the costs that it imposes on the rest of the system. You do that in two ways. First, you charge for the extra grid infrastructure that wind farms cause to be built. Secondly, in terms of the costs on the rest of the system, you go back to having the wholesale pool that we had in the early days of privatisation, where you bid to supply a certain quantum of power at a particular time of day. That would force—

Lord O'Neill of Clackmannan: Sorry, but, with respect, you seem to be obsessed with markets. There are engineering dimensions here. I suggested storage as something that might be a means of doing this. Do you have a specific answer on matters of a technical character relating to what we are trying to come to—a technical answer to the problem, which is resilience?

Rupert Darwall: I can suggest how resilience could be improved by having a pool whereby if you know that you have to and are committed to—

Lord O'Neill of Clackmannan: Sorry, but I have asked you about storage specifically. Could you give us a clear answer: do you think that storage is one of the means of undermining the bad effects of intermittency and is it worth the candle in terms of the cost?

Rupert Darwall: The most efficient form of storage is hydro power. If there are enough valleys that you want to flood with more hydro schemes, that would be the best way to go.

Dr John Constable: Can I chip in on this one? Technically, storage can obviously solve the problems. The question is whether it is affordable. If you look at renewable energy flows

from wind, wind offers you only one large charge-discharge cycle from which you can recover your capital. That is not sufficient, given the cost of current storage options, so you tend to retreat up the curve and find that the storage options are going to be dealing with relatively small fluctuations in wind, rather than large ones. So it is an economic question rather than a technical one.

Dr Robert Gross: Could I offer something on this as well? One thing that we need to be very clear about is the scale of the problem that intermittency imposes at what kind of penetration of wind and how well studied and how well understood this issue already is. When I led a review of this back in 2006, I think that we found 104 peer-reviewed or system-operator, National Grid-type studies into the costs and impacts of intermittency. Last night, when preparing for this, I read a couple of excellent reports from the International Energy Agency, reviewing both the engineering principles and the issues across countries, as experience is building, and some of the market adaptation and changes. I really would hope that the Committee, through the clerk and your special adviser, pays attention to and is aware of some of the excellent work that is already being done in this area and is not swayed by the kind of headline-grabbing think tank that is secretly a lobby group and has commissioned a retired engineer to come up with some oversimplifications and some very high numbers for the costs and impacts of intermittency. We have the grid upgrading costed by the electricity network and supply group at about £9 billion. If you annualise that and smear it out across consumers, and take into account the additional system balancing services that are likely to be required to manage wind and the impact on capacity and so on, and if you work through all that, with about 20% or so penetration of renewables on the system you come to a small number of perhaps 1p to 2p per kilowatt hour. The problems begin to arise when we start to look at very ambitious post-2030 combinations of very deep penetrations of renewables, with perhaps lots of solar on the distribution network and perhaps new nuclear stations as well.

To answer your question in a rather long-winded way, when one looks at those kinds of scenario, doing that without storage or intercontinental interconnection and those kinds of thing looks almost impossible. Storage then becomes terrifically important. But we must not exaggerate the scale of the problem that we are facing at the moment in an engineering and technical sense.

Dr John Constable: 1p to 2p per kilowatt hour might sound small, but you must remember that the UK consumes 330 terawatt hours per year, so it is not a small number when you multiply it.

Dr Robert Gross: All the numbers in the energy system are large.

Dr John Constable: The extra costs are in fact very substantial.

Q175 Lord Rees of Ludlow: We heard evidence from Dieter Helm, whose views you probably know. He felt that we should not subsidise present renewables but should go for gas in the short term and invest more in R&D into improved renewables. Do you agree with his general line? Can you perhaps say a bit more about your favoured future options regarding renewables and storage?

Rupert Darwall: I think that the problem with the push for renewables—and this comes back to Lord Hennessy's point—is that because renewables were the favoured technology, data and analysis that did not really support the adoption and aggressive rollout of renewables

tended to be pushed back. I fundamentally believe that the right policy framework is where markets can discover costs and those costs are internalised rather than socialised. Going back to my earlier point, if you had a pool, which the opposition party is promoting, it would force clarity of costing intermittency. It would give intermittent renewables investors incentives to develop storage technologies. It would give them incentives to team up with dispatchable technologies and to invest in dispatchable power. The costs then become more visible to the people promoting particular forms of technology.

Dr Robert Gross: While I do not disagree with much of that, I do disagree with the way in which what Dieter said has been phrased. I completely disagree with the notion that we could abandon deployment of low-carbon technologies now and put money into R&D instead and that some sort of magic solution will pop out at some point in the future. It is like believing in the R&D fairy. It flies in the face of everything that we know about technological change and it completely fails to engage with the amount of time that it takes to roll out large amounts of new infrastructure. This is an urgent problem, which we need to get on with. We will obviously discover better ways of doing things in 30 years' time. To the extent that we can, we need to try to strike the right balance. I have read the transcript and I think that Dieter was actually questioning whether we are striking the right balance. That is a very legitimate question, which we could explore more if we were not about to run out of time. To be absolutely clear, if you do not deploy anything, you do not get anywhere. You cannot build an offshore wind farm in the lab, you cannot build a PV factory in the lab and you cannot build a CCS pipeline in the lab. There are no magic solutions hiding—at least, not ones that will make a difference in the next 20 years or so. It is very worth while spending money investing in R&D in storage, for example. That could be hugely important and game changing. All sorts of things will come along that will improve things as we go along, but we should not just think that that is all that we need to do and that we can just wait for them to make a difference.

The Chairman: We have come to the end of this session, but does Dr Constable want to add anything as a last word?

Dr John Constable: Professor Helm's suggestions are extremely constructive as a means for trying to preserve something of the climate policy from consumer rebellion. We are looking at extremely high consumer costs for very long periods of time. It seems extremely likely to me that the climate change agenda will suffer as a consequence. That might be very unfortunate. There is a very good reason for having a climate policy, that is an insurance policy, but the premium has to be proportionate to the risk. Currently the costs are too high and Professor Helm's suggestion seems to me to be a way of shifting to a more reasonably priced insurance policy and thus keeping the public on board, which might be rather sensible. Do not forget that subsidies for renewables will be close on £8 billion a year in 2020. With additional systems costs, the figure will be well over £10 billion per year for decades. These are extremely high additional costs on the system and are very likely to produce consumer rebellion.

The Chairman: This session could have continued much longer and, indeed, other Members were trying to catch my eye at the end. I say sorry to them that we have had to close this session now. Thank you for what has been a varied session, with the three of you not entirely in agreement, but all the better for that, because it has given us a lot of further information, which we will need to consider carefully. We have been urged by you to make sure that we are not swayed unduly. We will certainly be looking, as always, at the evidence

base. If you feel that there is further evidence that you need to direct our way, do by all means send it to the clerk. Thank you very much indeed for a very informative morning.