



HOUSE OF LORDS

Revised transcript of evidence taken before

The Select Committee on Economic Affairs

Inquiry on

THE ECONOMICS OF UK ENERGY POLICY

Evidence Session No. 1

Heard in Public

Questions 1 - 15

TUESDAY 12 JULY 2016

3.30 pm

Witness: Professor Dieter Helm

Members present

Lord Hollick (Chair)
Baroness Bowles of Berkhamsted
Lord Darling of Roulanish
Lord Forsyth of Drumlean
Lord Kerr of Kinlochard
Lord Lamont of Lerwick
Lord Layard
Lord Livermore
Lord Sharkey
Lord Tugendhat
Lord Turnbull
Baroness Wheatcroft

Examination of Witness

Professor Dieter Helm, Fellow of New College, Oxford University

Q1 The Chairman: Professor Helm, I welcome you back to the Economic Affairs Committee. You were last in front of us when we were looking into fracking. Sadly, no wells have been fracked and no drilling has taken place since we last met, notwithstanding our report and recommendations. We are now looking at energy policy in the round, and I am very grateful that you have joined us today.

To what extent have the three objectives that were set been met—you have commented on them extensively in your writings—and to what extent are they the right objectives?

Professor Dieter Helm: The objectives are fairly well shared among most developed countries. Decarbonisation, security of supply and competitively priced energy is a nice wish list for people to have.

If we think about what has happened since 2013, we have had the gradual unfolding of what I call the Miliband, Huhne, Davey policy. This policy was based upon the assumption, shared by many Europeans too, that they were pretty convinced that oil and gas prices would go ever on upwards and probably double. There are endless quotes from the various Ministers to this effect. Therefore, they thought that embarking upon a programme of current generation renewables would meet all their targets, because they thought that, if the oil and gas price was going to go up, all this new stuff was going to be relatively economically competitive by about 2020, the subsidies could wither away, and the poor Americans, who

failed to follow the same line of policy, would find their petrochemical industries haemorrhaging to locate in Aberdeen to get near the relatively cheap offshore wind.

I say that in jest, but that is what is implied by the policy. In Germany, it was a serious industrial policy overarching the environmental policy. They thought they were building the new, cheap energy industries of the future. Of course, it has not produced competitive prices; it has not added to security—indeed, security is worse now than it was in 2013—and, on the carbon front, it may well be that the carbon production in Britain has been going down but the carbon consumption has been going up as we substitute domestic production for imports. What really happened in the Miliband, Huhne, Davey years was a dash for coal, which is about the dirtiest thing you can do from a climate change perspective. So it has not been good for climate change; it has not been good for security; and we do not have cheap electricity at the end of the road. It is not as bad as Germany; you can always find someone who has done it worse than we have done it.

The Chairman: Have you seen any changes in policy or changes in emphasis in policy in this Parliament?

Professor Dieter Helm: Yes, definitely. I think the incoming Conservative regime thought it would be a Liberal Democrat energy policy from 2015 onwards and that the Miliband, Huhne, Davey regime would carry on. When they found themselves in the majority, the first few months were spent reflecting on policy, which I think is perfectly reasonable, and the cornerstone of the policy going forward—the really big breakthrough—is the emphatic emphasis on closing coal, which is the most important single thing to do from a climate change perspective, and, like the Germans and everybody else, to recognise that the scale of the subsidies required was not going to wither away in 2020 and had to be brought into some reasonable bounds for current renewables. I make a very strong distinction between future renewables, which have enormous potential, and devoting so many billions of resources to the current renewables, which in their current state cannot make much difference to global warming and climate change.

Q2 Lord Layard: Could you just take us through some of the main instruments or tools that the Government are using and tell us to what extent you think they are rational and how well they have been implemented? Can I give you a little list?

Professor Dieter Helm: You can start.

Lord Layard: Could you comment on the renewables obligation, the feed-in tariffs, the levy control framework, the contract for difference and the capacity market?

Professor Dieter Helm: If you ask me to comment on the many tools, the flippant answer is: how many days do you have? It is a very serious feature of current energy policy that we have numerous instruments. Indeed, I used to jokingly ask people in DECC if they could name all the current instruments. This is not by some deliberate policy; it is that each problem that comes along gets a new instrument added to it. You have an energy efficiency problem and so you have the Green Deal; you have a problem with a particular kind of technology and you add another mechanism.

The first thing to say is that we have an immensely complicated set of policy interventions, many of which have long lost sight of the question to which they are supposed to be an answer. That is why it is very important to be clear what it is you think you should be doing, what you think the main market failures are and then design your instruments accordingly. So let us bunch these together.

The first and overriding problem is that the current market structure could not guarantee security of supply, because security of supply requires an excess margin of plant, and no rational capitalist in the world would ever deliberately overinvest to provide that cushion unless they were paid for it. That is why we now have a capacity mechanism. That is about fixing the total amount of capacity required, the capacity margin—full stop—and then making sure that happens. That, to its slight credit, is what the capacity mechanism is supposed to do.

A second problem is that we want to decarbonise. The obvious way of decarbonising is a bit like fixing monetary policy, which is that you pick a carbon price and allow that carbon price to adjust to whatever level is necessary to hit the target in the same way you choose an interest rate and allow that to adjust. We do not do that, I think for political reasons, because we do not want to face people with the true costs of their carbon consumption. We find other ways of getting to the same answer, many of which turn out to be much more expensive than a carbon price would be.

So we choose winners. We decide that certain sorts of technologies are going to solve our decarbonisation problem, for which read onshore wind, offshore wind and current generation solar—and now nuclear as well. Then we decide that we cannot let them compete to find the cheapest way of reducing carbon, so we have to have a special

arrangement for each individual technology. We have a FIT for nuclear, a different one for offshore wind, a different one for onshore wind, a different one for solar, and so on—a multiplicity of these things. It results in an extremely expensive policy to achieve the carbon reductions. As an aside, simply switching from coal to gas would have achieved all the emissions reductions we have currently made at an enormously lower price, and we could have spent the money on developing the technologies that really will solve our decarbonisation problems.

We had the renewables obligation certificates. The problem with those was that they did not include nuclear. We invented the FITs so that we could have a broader spectrum and arrange a special contract for nuclear power as well as a special contract for all the other renewables. We gave these feed-in tariffs—these new FIT arrangements—a peculiar characteristic, which was that we tied them to the wholesale price in principle but not really. This is a piece of complexity that really is important to understand, because the contracts for difference are just an expensive add-on that is not actually necessary.

You will recall that I said that Miliband, Huhne and Davey all knew that the oil and gas price was going to go ever upwards. They thought that, since these renewables would be in the market and relatively cheap compared with this very high oil and gas, they would be paying back money to us. So they offered a fixed-price contract for each of the technologies, but the CFD works essentially to pay us back some if the wholesale price goes above and to take more out if it goes below. The answer is that it is always going to be below, and there are many complicated reasons for that, but it does not really matter because the actual technology just has a fixed-price contract. We pay £92.50 per megawatt hour for Hinkley; we pay £100 and whatever it is for offshore wind; we pay £50 something for particulate solar, and so on and so forth. If I am boring you with the complexity, that is an observation of how difficult and badly designed our policy has become.

The one bit that makes sense in this framework is having a capacity market, which is simply saying that the system will not provide enough capacity; therefore, we should auction to whoever can bid to provide this capacity. So they bid in to produce the particular outcome. That does not mean that we have not designed one of the most complicated capacity mechanisms you could possibly think of; we have not segmented it into four different bits; we have not decided, on the one hand, to try to design it to produce gas power stations as a

result but in the process pay enormous sums to small back-up generation such as small diesel, OCG generators, and so on and so forth.

The short answer to your question is that I do not think I could even list all the policy interventions. They have been made on a piecemeal basis, ad hoc as you go along, and I hope I have explained, probably very badly, some of the difficulties in some parts of what has been put in place.

Q3 Lord Kerr of Kinlochard: Dieter, has the capacity market option in fact, yet, produced any new-build combined cycle gas turbine stations?

Professor Dieter Helm: The answer is no. One of them did win the competition first time round, but because it has not got off the ground—at Carlton Power—it has been withdrawn, although I understand that is going to be subject to some legal action, but I am not sure. The answer is no. The game that is going on in town at the moment—you can read this in the consultation paper from March—shows the utter confusion in government between those who think that markets are useful because they do not know the answer, so let us see what the right answer is from the market, and those who believe they know the right answer but want to use a market mechanism to try to produce that result.

What has happened this year round is that the volume of capacity has been jacked up to a level that looks so high that only a couple of CCGTs can make it, although you could produce an infinite number of small diesel generators if you wanted to, and the idea is that this will produce two CCGTs. In the consultation paper, on the one hand, it says, “We are completely technologically neutral”, and later on—I paraphrase—it says, “We expect this to produce some gas power stations”. You try and make it up; I struggle.

Lord Tugendhat: In fairness, Professor Helm, you have described the energy policies of the coalition Government as returning the UK to a level of state intervention not seen since the days of the CEBG and British Gas. You also describe the Department of Energy and Climate Change, without intending to do so, as becoming the micromanager of the electricity system. I found that very thought-provoking, because back in the 1960s I was writing about energy for the *Financial Times*, and my impression was that Walter Marshall at the CEBG and Denis Rooke at British Gas were not exactly micromanaged. The CEBG and British Gas were both state enterprises, but both Walter Marshall and Denis Rooke were extremely powerful individuals in their own right, and the difficulties the Government had in denationalising British Gas were an example of that. I think, if I may say so, that you are understating the

situation and that the degree of micromanagement is much greater than it was when Denis Rooke and Walter Marshall were in their prime, especially as Walter Marshall was so well in with Mrs Thatcher—at a later stage, of course.

Professor Dieter Helm: Although not enough to preserve his nuclear power stations. We had a policy in this country—I put aside its merits or demerits—which was, basically, that we were going to let the market decide how much to invest in, what to invest in, what the prices should be, and we would do this by having, essentially, regulated third-party access to the networks: anyone could use the networks; anyone could build a power station and take the risk in the pool; and customers could switch between suppliers. It was the liberalised model, which is in fact almost the entire basis of the internal energy market in Europe. We were the advocates of this decentralised, competitive market framework, and the real architect in the background was Nigel Lawson with his market for energy plan when he was Secretary of State; I think the speech was made in 1982.

What we have done is the most incredible U-turn. We opposed the alternative model to this, which the French put forward, which was called the single-buyer model. We said the state should not be involved in determining how many power stations there should be, letting contracts, all this kind of thing. It was for the market. Now we have the most extraordinary single-buyer model you could conceive of. Every single investment in electricity generation in this country is determined by the state. It comes with either a capacity contract or a feed-in tariff. Nobody can build anything in the absence of those contracts. It was thought that we would only have the state as the single buyer for renewables, with different prices for all the technologies, but it only dawned on Miliband, Huhne and Davey late in the day that, if you put all this renewable and intermittent generation on to the system, a gas station could no longer rely on running all the time to depreciate its assets, and, since it could not rely upon that, it could not rely on the wholesale price and, therefore, it would need a fixed-price contract too. It would need capacity contracts, which were grafted on after the FITs, which replaced the ROCs. There is nothing built in this country that does not depend upon the state and a state-backed contract. Hinkley is just the same, regardless of the Government's unwillingness to inject finance in and preference to pay 10% real to the French and the Chinese, which we might come back to.

How does it go about this? It could say, "We are the central buyer but we will just buy a quantity of capacity"—the total capacity market—"and we will ensure that this meets the

decarbonisation objective". I proposed a single unified auction to do that, so it would still be a single purchaser but it would not be micromanaging who is bidding for things; the market would do that. On the contrary, it has a different price for every single technology. Is that more or less micromanaged than Denis Rooke and Lord Marshall, the CEGB and British Gas? In one sense, it is less micromanaged because it is still private firms making these decisions, whereas these were state enterprises doing it, and, ultimately, the boards of the state-owned enterprises were answerable to the Government as opposed to the normal private sector.

But, in the way you suggest, it points in the other direction because Lord Marshall and Lord Rooke and others—I think it was Sir Denis Rooke actually, not Lord Rooke; I must be respectful in this House to get the titles right—were left basically to get on with their plan. If you think about what both of them did, Denis Rooke was responsible for the development of natural gas in this country and the investment framework for the development of the offshore North Sea gas industry. He passed an Act to say that everything must be landed in the UK. He organised that British Gas built the pipelines and did the retail switch and industrial switch, in line with the investment offshore. Lord Marshall ensured security of supply, but his view was that security of supply would be best met by building lots of coal stations and lots of nuclear power stations. So we had an 80:20 mix—80% coal, 20% nuclear—and that was back-to-back with the coal industry, which had the Plan for Coal, if you remember, from the 1970s after the OPEC shocks, et cetera. They are different, but the degree of state intervention we now have is more akin to the nationalised model—that is why I called my piece *The Return of the CEGB?*—than it is to the market process we were following before Ed Miliband became Secretary of State. That is a very sharp discontinuity. I am not advocating the merits of either system, but it happened almost by default. It was not a conscious set of decisions to do this, but the state is completely embedded in our energy system now.

Q4 Lord Lamont of Lerwick: How would you reconcile the decarbonisation objective with the purer market structure you outlined at the beginning, and would you be able to have one price for each technology with decarbonisation as well?

Professor Dieter Helm: The obvious way of thinking about this in theory—and you have to think about practice—is that it is a pollutant. It is something not priced in the market; so you have a price of carbon. The price of carbon is whatever level is necessary to achieve the

target, and then you have an auction for capacity and everyone has to internalise the price of the pollution they cause. You will find that you will hit the carbon budgets, and therefore the Climate Change Act target, and the capacity requirement, Q and C, from a single auction. As I said earlier on, I do not believe, politically, that anyone is prepared to tell the public that they are the ones who ultimately are responsible for the carbon pollution because they buy the stuff that the carbon is embedded in, they drive the cars, et cetera. So they want to find a way round it.

I thought of a less perfect model but one in which we have a two-stage auction. We say, “This is how much capacity we want”. We ask everyone to bid anything they would like, and then we look at the first round of bids and ask whether these are compatible with our carbon targets. We now know how much it costs for the various things, because we have seen the market bids from people, and then we have a constrained second auction. It is a bit like the situation where, if I want an extension built to my house, I might ask a load of builders all to bid, and then I look at the bids and think, “Actually, I only want the ones with yellow bricks really. Could you all now bid with that constraint in mind?” Everybody knows what the carbon budget is, so there is no lack of information.

This is a perfectly marketable-driven outcome, but there is a result. If you took the market route, you would not have any offshore wind, for a start. Nobody in their right mind would build an offshore wind farm compared with the much cheaper ways of reducing carbon. If you are only concerned about reducing carbon, we would not have expanded our coal burning until relatively recently; we would have closed it, because the switch from coal to gas is the cheapest way of doing this immediately.

There is a separate argument, “Oh, yes, but these are infant industries and we need to support them to get them into the market”. You have to ask how many tens of billions you want to spend to work out how to erect an offshore wind turbine compared with the other alternatives that are available, such as investing in opening up the light spectrum, developing solar film, and thinking about graphene and nanotechnologies for next-generation solar.

There are always alternative ways you can spend money. If anyone really thinks that you need to spend the sorts of scales of money that have been spent here and particularly in Germany—German customers pay €23 billion a year for their roof-top solar of the first generation and their wind farms—this is an extraordinary way, given the options available,

to concentrate. You would do a bit of R&D. You would be very clear that this is an infant industry specialist idea to try to see whether offshore wind farms work, but you would not put the bulk of your subsidies into working out how well to erect offshore wind turbines, given the cost structure that they confront compared with the other alternatives.

Lord Forsyth of Drumlean: Lord Lamont has touched on half of my question, Dieter, but I do not really understand what was wrong with the Nigel Lawson competitive model. Is it because of the carbon objectives? You said you did not want to comment on the merits of either model, but I would quite like to tempt you in that direction. Clearly what we have now is a shambles.

Professor Dieter Helm: This is the famous speech on the market for energy. Ed Miliband's speech in 2009, which set his direction as a reset of policy, was deliberately modelled on the Lawson speech. You should read Miliband's speech—I think it is in 2009, in something like October/November, given at Imperial—and Nigel Lawson's 1982 speech next to each other. Nigel Lawson's approach, which is very straightforward, is to say that the state is doing all this stuff that markets can do, and what we need to do is get the state out of this framework; and, although he did not say it in 1982, he thought that privatisation, liberalisation and competition was the model. He looked at the Department of Energy and saw it doing all this modelling, planning, forward guidance, and so on—all the stuff it now has to do. We have reinvented the pre-Lawson Department of Energy to do the same task, but there were certain flaws in it. They are really flaws about the circumstances in which Lawson found himself, as opposed to Ed Miliband and subsequent people.

In the recession in 1980 to 1982, we lost 25% of manufacturing industry. People forget how sharp that contraction was, but we had been building electricity capacity on the post-war idea that a 3% economic growth meant a 7% growth in electricity demand. For example, the youngest coal-powered station in Britain, Drax, which is 4 gigawatts, was part of that to meet that demand, which we had successfully done since 1945. We had this huge overlay of capacity, a juggernaut of stuff coming on stream, and demand collapsed. Nigel Lawson faced a world in which there was no question of security of supply. We had 40% excess power stations. So the job of the Lawson era was to sweat the assets. Nobody cared about investment because you did not need it, and, of course, Lord Marshall wanted to carry on investing in this context.

You will remember in 1980-81—I will have to get the dates right—that David Howell announced in the House of Commons that we were going to build 10 nuclear power stations, one a year, and 14 years later we got Sizewell. He inherited a world in which people thought we wanted to carry on building stuff when actually there was massive excess of supply. Security of supply was not a problem and sweating the assets was the objective. You could argue that, roughly, Lawson's policies were right for the period.

The world we now found ourselves in is a world in which the capacity margins are effectively nought, so the security of supply problem is back with a vengeance and we want to decarbonise—or, at least, it is official policy to decarbonise—whereas when Thatcher made her speech in 1988, 1987 or whatever, climate change was not on the horizon. We have new problems of our context, which Lawson did not face, and it is inevitable that the structure had to be adapted.

The questions are the following: could you get the market—it is the question Amber Rudd raised, and others in DECC have been raising recently—to achieve the problems of our era in the way you might have done before? The answer is: yes, of course. Price carbon—that is what markets do; they take prices into cost—and auction capacity. The bit that he probably would have resisted is the idea that the market would not generate sufficient investment in surplus capacity to guarantee supply. I have always thought that problem remains. That is why my ideally single unified auctions, the FITs and the capacity market, all in one, just auction forward, or, if you do not like that and politically it is difficult, the two-stage auction is more consistent with the market framework than the state-planning one. That said, if you are going to state plan in the way we are already doing it, there is an alternative argument: just do it properly.

The Chairman: Moving on then—

Professor Dieter Helm: Lord Marshall and Denis Rooke would make a better job of where we are now. We really have a choice. If we want to stick with what we have, then just, effectively, control it. You do not have to nationalise it. We did not nationalise GEC for them to build the power stations for the CEGB, and we do not have to nationalise the developers of power stations, but we have nationalised the risk of the contracts. Arguably, if you are going to pay 10% real cost of capital for Hinkley for 35 years and the state cost of borrowing is pretty close to zero—by the way, if you do it at 5% instead of 10%, the cost of Hinkley halves, and we are talking about the most expensive power project in the world—there is an

argument that says the halfway house is worse than either of the alternatives. I probably think that is correct.

Q5 Lord Kerr of Kinlochard: I ought to declare interests as a former director of Shell, a former director of Rio Tinto, a former chairman of Imperial and current director of Scottish Power. Right, Professor, let us put you on the spot. Which do you prefer of these two extremes? What is the correct relationship between the public and private sector on energy policy, and could you add who should pay for government energy policy? Should it be the taxpayer or should it be the consumer, which is slightly more regressive than that?

Professor Dieter Helm: I need to add one more component to this before I give you a direct answer to your question. We are in a period of extraordinary technical change. Whereas I am very critical of current renewables, there is an explosion of future—particularly solar—new technologies coming down the track. We have the digitalisation of the economy. The demands relate to robotics, 3D printing, artificial intelligence, and so on. Most of manufacturing will be digitalised, and anything that is digitalised is electric. This is all—or most of it—zero marginal cost. The wholesale market is on its way out. This is much more like the economics of broadband.

In energy technologies, we have a host of new technologies coming in generation. I am particularly excited by opening up the light spectrum. It has nothing to do with deploying all these things on people's roofs; it is about science and getting more of the light spectrum and capturing it. I am very excited by graphene as a way of helping to do solar film and applying solar film to virtually everything. It may never happen, but there is lots of stuff happening. We have huge advances in batteries. We have the electrification of transport taking place. We have enormous development in peaking technologies. We have smart meters. We have all sorts of stuff.

The chances of government getting it right when there is massive technical change—with due respect to yourself and other people in the industry who work hard, with lots of people who have deep, vested interests in preserving the existing assets such as German companies and so on—are very low. In this very entrepreneurial period—it will take time for this to settle down—I am very wary of going down the state route. The whole point about markets is that it gives a lot of chance for entrepreneurs to fail as well as to succeed. My inbox is full of loads of people who want to start businesses all the time. "Can I talk to you about this? What do we do about that?" They all want to lobby government to get a bit of money out

here and there. The incumbents want to protect their assets going forward, understandably. They just have to look at the decimation of E.ON and RWE in Germany to see what happens in these worlds. I think you have to go a long way to give me a really good example of the state managing rapid technical change with the uncertainties where everybody is after the rents.

My answer to your question is that I prefer the market route and I have proposed a way of balancing what the state needs to do, which is to fix the amount of carbon and to fix the quantity to ensure the lights stay on and we have a decent capacity margin, and then let the market get on with the component parts. That is a perfectly plausible public/private partnership.

Who should pay? Taxpayers and electricity customers are actually pretty well the same sorts of people. You might say it is regressive that people might pay for their carbon pollution, which is what you are doing when you are paying for lower carbon energy, and it might be regressive to get people to pay for security of supply. On the other hand, it is pretty regressive to get people to pay for bread and all sorts of other things. But there is a very important public policy point here, which I think people have not grasped.

If it is true that the wholesale price is gradually withering away because most of the technologies are zero marginal cost, you cannot switch from system-fixed costs; you cannot switch from the contracts for differences in the FITs; you cannot switch from the capacity contracts; you cannot switch from the grid; you cannot switch from distribution. Increasingly, the bills that customers pay will not be switchable. They are just fixed. It is a tax system, in the economic theory sense at least. Then there is a really interesting public policy question. Should industry that is internationally competitive pay more of the fixed costs or less? Should poorer customers get less or more? It has absolutely nothing to do with switching. It has completely passed the CMA by in thinking about consumer markets, but we do have choices. You could make the electricity charges less regressive—that is what the CEGB did, and people in the south-west did not pay the full contribution—or you can try to pro rata its costs, but it is not marginal cost base.

That is an open question, whereas the answer to your first question is that the market is better when there is fast technical change. I am sorry it is a complicated answer.

Q6 Lord Darling of Roulanish: I declare an interest that I am now a director of Morgan Stanley bank. I want to ask you about the capacity point. As I understand it, to get more

capacity, the current policy is that you enter into a single contract to get someone to build a power station and/or you pay through the nose to get additional capacity where you can, if you think you are going to reach a situation where there is zero margin. Is that right?

Professor Dieter Helm: Yes. The wholesale price goes through the roof at the point where supply and demand comes together.

Lord Darling of Roulanish: You said in reply just now to Lord Kerr that, if the public policy is that we should not run out of electricity, it might be better to say, “Therefore, we should have capacity of X”, even if it meant that we may have a redundant power station. You are saying that is a public policy decision and, okay, we have to pay for it, because it seems to me the private sector has no direct interest in whether or not we run out of electricity. If they do not fancy building a power station, why should they?

Professor Dieter Helm: I think I agree with all your points. Security of supply is a system property. You cannot buy security of supply for yourself. It is a bit like being protected by—I do not know—nuclear weapons or something. Whether your lights come on when you turn them on does not depend on whether you bought a security contract. It depends on whether there are enough power stations in the system to meet that. Of course, supply will always equal demand. There is always a price at which supply and demand will come together. The argument is that the state has to fix the total quantity to give a security margin so that customers know that there is sufficient capacity available. That is what the capacity mechanism is designed to do.

Lord Darling of Roulanish: A body, whether it is the Government, an agency or someone, would have to decide that this is the capacity we need in the system.

Professor Dieter Helm: Yes. That is currently done by a combination of DECC and the system operator and National Grid through an iterative process. In the old days, under Lord Marshall, 20% was the answer.

Lord Darling of Roulanish: Looking at this again, because I was one of the authors of many of the White Papers that you have been so critical of, it struck me then to some extent, and quite a lot now, that what has happened is that policy decisions are being made in relation to capacity and the environment, and rather than saying, “Do this or that”, we are trying to create a market mechanism to bring about the result in a way that the market was never intended to operate.

Professor Dieter Helm: There is no problem in saying that we want a 10% capacity margin; therefore, we want so many gigawatts of power built, and we will auction those contracts. That is what the capacity market does. The auctions are very competitive; indeed, they are much more competitive than what used to happen in the wholesale market. Anyone can bid. I could set up a power station. I am not encumbered by having to compete with big power station owners like the “big six”, and so on. Anyone can compete in this market. You just bid to deliver what is a public good.

Lord Darling of Roulanish: There are two elements here. There is the public good question, whether it is carbon or capacity, and then, having decided on that, you say to the market, “You bid to provide whatever we say”.

Professor Dieter Helm: We decide what we want and the market delivers. There is a twist on this, which comes back to my comment earlier about not knowing whether they want two gas CCGTs or they just want the technologically neutral market to deliver the outcome. What has effectively happened this year is that the volumes, and so on, have been played around to try to produce a big enough number that will produce two CCGTs, or three, or whatever. The consequence is that everybody else is going to be paid the clearing price necessary to bring the gas stations on. Suppose the clearing price for gas stations is 40, but there is almost an infinite number of people who would build a little OCG gas station for 20. We are going to pay 40 to every one of those 20s, and that is a huge intramarginal rent of customers’ money that is being paid to jack the capacity auction up to produce the prior result the Government wanted.

This comes back to an earlier question. We are in this halfway house. If the Government just did it—CEGB style—they would send a contract out for two gas stations, completely separate from a contract for something else, and say, “We want this, this and this in capacity”, and just do it. We would save a very large chunk of customers’ money in the auctions, which is now going to go as, essentially, economic rent to the small producers of the little generators who would have otherwise come on the system anyway.

Lord Darling of Roulanish: Can I also ask you a public policy point in relation to capacity? To what extent, if Hinkley is ever built, will it fill the gap we now have, bearing in mind that—I think I am right in saying—the vast majority of our nuclear power stations are in the twilight of certainly their planned lives, and, I suspect, that coal is being phased out, but our other

power stations are hardly youthful? I cannot remember when we last opened a decent-sized power station. How acute is the problem?

Professor Dieter Helm: Factually, apart from Sizewell B, which is a PWR that came on in 1994, the rest are Magnox and AGRs, and they will all essentially come to the end of their lives in the next decade or a bit beyond. People use the plumbing to keep them going because they want to delay the decommissioning costs, but they will all virtually come to the end of their lives. The youngest coal-powered station in Britain started—or the first part of it—in 1974, which is Drax. There is nothing that is less than 30 or 35 years-old on the system, and all that is going to close in the next few years. But there is some new kit on the system—some CCGTs, and, ironically, those are not being used full time. It is quite an extraordinary set-up.

The plan originally was to bring on Hinkley in 2017; then it was 2020, then 2022, 2023, then 2025, and now it is at no known date, as far as I understand the official position. It is 3.2 gigawatts, which is 7% of total capacity, but the plan is to build 10 to 12 gigawatts of new nuclear and to do that before the end of the 2020s.

If you think about a system, imagine a world in which you might have 10 to 12 gigawatts of new nuclear on the system, or you might have none, and you do not know when it is going to turn up, and you are going to close all your coal stations in the process, which are the base of your system, while you are building much more intermittent capacity on the system. It is not a very good place to be.

Lord Darling of Roulanish: The theory is that the market is deciding to do this.

Professor Dieter Helm: The market is reacting in the following sense. It is responding to the capacity mechanism as designed and building new, mainly small, peaking capacity to respond to that. If the price is high enough and capacity contracts are offered accordingly, it will build some more gas. The coal is being closed because, first, it is government policy—it is very polluting—secondly, the coal/gas price is beginning to close up; thirdly, it is incredibly old and the maintenance costs are very large; fourthly, and finally, it only gets the wholesale price, which is not going up ever towards £92 per megawatt hour but is now down to about £30 and heading south. They are uneconomic anyway and you would not spend the money putting them back together again.

Nuclear is quite a big story in this in two senses. First of all, even if you build it, you do not know when it is going to turn up. If I was thinking about an investment for 2025, it might be

that my investment comes in when there is a huge wedge of 7% of extra capacity coming on the system at the same time, deflating the prices, or it might not, and I do not know. From the system as a whole, do you want to take the risk that you do not have enough capacity on the system because you believe that EDF's plant is going to turn up on time? What are you going to do on standby if it does not? The answer to this problem is that I think nearly everybody now agrees that we are going to have to build a lot of gas and we are going to have to get on with it.

The question then is: are you going to design a capacity auction like the one we have, which is a very expensive way of building new gas, or are you going to get serious and just get it built? This is not for the long run but just to get us through the next decade, because, recall, we are the fifth, sixth or seventh biggest economy in the world and our capacity margin is effectively nought. This is an extraordinary position to drive yourself to where people can think about investing in this country and wonder whether the capacity is actually going to be there to provide this basic necessity of electricity.

Lord Darling of Roulanish: Just to be clear and to finish this point, the Government, or someone, would have to decide we need X number of gas-fired power stations unless, by some stroke of luck, you get Hinkley Point power station.

Professor Dieter Helm: They either have to decide to buy a particular technology or they have to decide that they will auction sufficient capacity such that there will be sufficient investment in gas to meet the gap. It is the Government who will have to decide that, and, in particular, they will have to decide whether to auction enough extra capacity to cover what happens if the nuclears are not built either on time or in the totality that they are promised. You do not have to say it should be CCGTs, but the current market makes it very expensive not to say that in the way it is designed.

My view right now—given that we are in a situation of nought on the capacity margin, whatever you like, the fineness of markets and how you want the structure to go—is to get two built now. That would be my policy.

Q7 Baroness Wheatcroft: You have made very clear your views on the economics of Hinkley Point. Do you think there is any scope for renegotiating the terms on that and on other potential nuclear plants?

Professor Dieter Helm: The economics of Hinkley fall into several boxes. I think the decision to build a nuclear power station is a political choice. It involves future generations, waste

and time horizons—remember, this thing may run for 60 years—over which no rational market can make a judgment about future prices; and it has military connotations, because there are not many military powers in the world that are nuclear that do not have a civil programme. There are lots of aspects to that.

I have no view, qua economist, as to whether that is a good or a bad political choice. I have always said that, if you are going to do nuclear, do it properly. I have two components to that. The first is to recognise that it is a political contract, that it is a political and regulatory risk, and therefore that the state is the cheapest form of capital to carry those kinds of risks. The state could borrow at—I do not know; you tell me what the state could borrow at at the moment—as opposed to 10% real for 35 years. I proposed a long time ago that the Government should raise—I do not know—£20 billion or £50 billion of nuclear bonds, give them a Treasury guarantee, float them off in the market and then auction, having maintained ownership of the nuclear sites, to anyone who wanted to build these things, and give them the finance to go with it. The cost of that would be at least better than half the cost of the current programme.

I also think that the second part of doing it properly is to have a serious nuclear programme. There is very little point in building one. I am very questioning of the idea, as we did under Tony Benn in the late 1970s, of the “Let us build one and see what happens. Let us try each one out and see if we can get the right one” kind of approach. We are going to build three different types of nuclear power plants at the moment, and presumably we are going to try them out and see which one works. That is a very expensive policy for an energy system to pursue.

To their credit, the French did it properly. They decided on the design and they built 58 of them. They built the supply chain to do it. In one year they were constructing six simultaneously and rolled out this programme. Whether it is a good idea or not, if there turns out to be a structural or fundamental fault in a PWR, France has lost 80% of its electricity capacity. There are some quite serious issues that confront this system, particularly towards the end of life, but that is what nuclear power involves.

We have chosen probably the most expensive way to do it. We have had to involve the Chinese, because the British Government cannot raise the money, and introduce the Chinese into what is an extremely sensitive industry, and, apparently, promised them that we will let them build their own prototype in Bradwell in order to develop their own nuclear industry

worldwide. We have no certainty about the programme and there is no coherence in the supply chain between the different reactors. That is why a lot of it will be French in support. As to choosing whether to do nuclear or not, I am, in a serious sense, neutral about it as a political choice, but if you are going to do it, do not do it this way. We could do it much cheaper. Could we renegotiate now? I have always thought that anything is possible over this frame. We have multiple relationships with France. My interim proposal was that the British Government should buy the Centrica stake when Centrica withdrew. Just take it over and then securitise it. If we are going to have a serious nuclear industry in Britain, better an Anglo-French project or an Anglo-something project so we could have our coherent nuclear industry. It does not look like that at the moment, but that does not mean that I think it is a bad project. That is a kind of pragmatic thought about how we might do it a bit better.

Baroness Wheatcroft: They are fascinating pragmatic thoughts. Do you think we are looking backwards rather than forwards in nuclear in that we should be looking at much smaller reactors—regional reactors?

Professor Dieter Helm: It captures the political mood too. The new sexy thing is small modular nuclears, so we are going to build lots of these little ones and get the guys in Manchester to develop these and be the new leading industry. Let us be very clear what a small modular nuclear is. It is a small PWR. Instead of having the economies of scale, scope, and so on, for a 1.1 gigawatt or 1.5 gigawatt nuclear reactor, let us have 15 of them, or however many you want. It is perfectly possible to make small nuclear power stations. We have them in our submarines all over the place; we have them on ships and all sorts of stuff. But there are inherent cost disadvantages in doing it this way.

Then there are the politics of this. People think that small modular nuclear reactors are going to be much more acceptable than big ones. So you say to the people in Somerset, “Would you like a socking great twin PWR?”, and you tell them there will be lots of jobs and supporting infrastructure in the area, or you tell the people of Sellafield who have got used to it. There is a difficulty, but they accept it. Now you want to go round every town in Britain and say, “Would you like your own nuclear reactor?” I can imagine the student demonstrations in nuclear-free Oxford that are going to come from our own little 100 PWR. To take this on in 20 or 30 cities in Britain seems to me to be not thought out.

A separate issue is: are there next-generation nuclear reactors we ought to be exploring, and could some of those be small? Yes and yes. Should you invest in some of the R&D? Why not?

We are a science-based economy. We used to have really good nuclear technology too. This is a future industry. We have a nuclear small fleet in the subs, and so on, so, yes, by all means, but not the current modular, bastardised PWR at 100 megawatts and you think you have solved your political problems because it is small.

Baroness Wheatcroft: I am interested in what you say about the potential demonstrations. Is it wrong to perceive that the public are much more relaxed about nuclear now?

Professor Dieter Helm: I do not know. That is out of my remit. I am not one of these people who does opinion polls and voting surveys. I hear they do elections and referendums too, and it seems to me that there are some difficulties in that area. But in nuclear it is a classic question of asking people to make choices—people who do not understand the choices they are being asked to make, for obvious reasons. I do not understand how nuclear reactors work. How would the public? They are told things about the risk, sequentially: there could never be a disaster like Fukushima, and of course the Windscale fire was hushed up years ago. People at one level are quite rational; they just do not trust the information they are given and they do not understand it. That leads to an obvious conclusion. It is different in Germany because the Germans were on the front line of the Cold War and faced the prospect of being fried for 40 years. Naturally, the issues of cruise missiles and all those things led to a different view about nuclear proliferation and the things that went with it. I have nothing else really to add to that.

Baroness Wheatcroft: But, in conclusion, whether or not Hinkley Point happens, you think we should get moving on gas quickly.

Professor Dieter Helm: We have no option. We will get moving on gas. It is just a question of waiting for things to get really serious and do it, or we do it a bit before they get very serious, because they are currently serious. The capacity margin is 0% or 1%—it is trivial—and that is not where an advanced economy should be.

Lord Lamont of Lerwick: If you exclude coal, is the nuclear particularly suited to the baseload function?

Professor Dieter Helm: It does provide baseload. There are other ways of providing baseload. If you look at the scale and the kinds of technological change taking place, there is a question about the old idea of the baseload and the merit order being yesterday's problem. Once you have a lot of very flexible, fast-reaction technologies and you have battery storage, your need for baseload becomes different. I do not know exactly how it

becomes different, which takes us back to my answer to your question about whether the Government or markets should do this. We are playing this forward. An example would be if every household had a household battery and used it to take power off the system when the intermittent stuff was working and not otherwise, and charged its car in relation to that, and if every time you went to the supermarket your car charged up or charged down in the car park. All these technologies change the nature of the fundamental requirements of the system, so whether you need a big core of baseload is at least an open question.

The advantage of gas—and it is only an interim advantage—is that it can be both baseload and flexible. Nuclears can only be baseload. You just cannot turn the things off. You can see some of the problems that emerge in Germany, where at times the price goes negative because you have to dispense the power on to the system and there is a lot of other zero marginal cost on the system and the system starts to crack. It is not the same, but the analogy is with negative interest rates. People start to do very odd things in those circumstances, such as store the money under the dog because it does not lose you money as it might in a bank, and all the kinds of things that go with that. It is an open question as to what you do for baseload. Do you need 10 to 12 gigawatts of new nuclear baseload? Probably not, but it might help.

Q8 Baroness Bowles of Berkhamsted: Moving on from what might be locally contentious to something else that might be locally contentious, do you think that the UK Government should have done more to support indigenous shale gas reserves, and, I suppose, in conjunction with that, take into account what is happening with gas prices and their convergence?

Professor Dieter Helm: There are a variety of answers to that. First, the easy idea that, “Well, they did it in the United States, so we can do it here”, is nonsense. In the United States, first of all, the property rights system is completely different. You own everything under your ground and therefore you have every incentive to extract the stuff. We do not have that property rights system. They have quite substantial open spaces in which to develop this stuff, whereas we have a small, crowded island. The circumstances are extremely different. The cost structure is almost certainly higher in the UK than in the US, and that is before the fall in gas prices. There are many questions to ask before you go down this route. However, if we, as a country decide, the Government decides that this is a major resource to be developed, the analogy is with the development of the North Sea.

How did we develop the North Sea? On the gas side, British Gas was given the monopoly of accepting all landed gas in the UK. It developed its pipeline system to match what was happening offshore, and it was a national strategy. Although, as I say, I would probably much prefer a market approach to these things, the story of what Denis Rooke did in the conversion to natural gas is one of the greatest successes of nationalised industries I have ever come across. It was rationally planned and cost-effective and was done in an orderly and timely way, and we developed the North Sea gas side.

On the oil side, we had BNOC, which was not an unbridled success to say the least. In fact, one thing that Nigel Lawson did early on was to unbundle BNOC, take out Enterprise Oil and do all sorts of things on that front. Nevertheless, the Government took a very powerful position on providing a framework and the legal structures for developing offshore oil.

If you really want to do shale, you have to think about the infrastructure, the locations, the supply points and the regulatory regime. You have to do all these things and have a strategy for doing it, and we never got there.

But is it economic to do it in the current circumstances? The world is just awash with gas. There is gas everywhere. It is incredibly cheap. Could you frack for gas in the UK for less than you can buy LNG cargoes from the US or Qatar, which was built to supply gas to the US market, which no longer imports? People think that the US might export, but the key thing that they do not understand about the gas market is that the US no longer imports. That huge development in Qatar and elsewhere was built on the assumption that the biggest demander of LNG gas would be the United States, which it no longer is. This gas has to go somewhere. We are not short of gas. That raises the question about current gas prices, future gas prices and why anyone, except in special circumstances, would bother. INEOS will import ethane—LNG—from the United States into its Grangemouth terminal, because it is cheaper even than the natural gas supplies that it could use from an ethane base. If you really want to develop a whole new industry, you need a strategy to do it, and, for good reason or bad, we do not have that strategy in place. But the resistance is very large and it is not going to go away because of the nature of our country.

Lord Forsyth of Drumlean: But are you not missing out the security of supply argument, given the instability in many of these areas?

Professor Dieter Helm: To take that question seriously, my answer would be: what insecurity? We have a whole stack of LNG terminals. We have cargoes all over the place. We

have enough installed LNG in Europe to nearly meet 50% or 60% of total demand. This is in a world in which we are awash with gas, we have difficulties with Gazprom and Libya, and we do not yet have a Turkish-related corridor. There is no shortage of gas, and the chances of there being a shortage of gas and a strategic problem with gas to my mind are extraordinarily low. The numbers are there. For policy purposes, when you are thinking more generally it is much better to assume that the supply is effectively infinite than it is to take some peak gas or peak oil notion and the idea we are going to run out of stuff. There is plenty of gas in loads of locations. We are discovering it on a regular basis. We are even discovering it in the Mediterranean, still. So I would not worry about that.

From the point of view of the UK, we have multiple sources. We have Norwegian supplies and upgraded pipelines. We have lots of LNG terminals, we have links to the continent, and we still have quite a lot of North Sea gas. Why spend public money trying to solve a problem, which, if it ever existed, is a decade or more away and by which time other technologies may come along anyway? I do not buy the security of supply argument. I respect other people who think that, but I ask them to tell us the scenario that would genuinely lead to a security of supply crisis in Britain, and it is not turning off the pipelines to the Ukraine; it had no effect at all.

Q9 Lord Burns: We often hear it claimed that high-energy costs have been a major factor in the decline of our industrial capacity, and I have listened to the man from INEOS talk about this at length. We also hear that our consumers are paying much higher energy prices than other people are paying. What is the position on this? With regard to some of your suggestions, is it taking other people's energy? Is this just guaranteeing or locking in the fact that we will be uncompetitive relative to some of these countries for high-energy industrial activities?

Professor Dieter Helm: We may be uncompetitive in energy-intensive industries for lots of different reasons, only one of which is energy cost, but the clue is in the name: energy-intensive industries. We basically closed them all, or nearly all. Tata Steel is still there, but there is hardly anything left. Part of that is an exchange-rate effect for having North Sea oil and gas and the things that happened in the 1980s and 1990s, but we have been de-industrialising at that level for a very long time. We do not have much left. That is the first point.

The second point is that, yes, we do have high energy prices, and part of the reason for that is that we have a unilateral climate change policy, so we have our own unilateral targets and our own unilateral carbon floor price. Put aside whether the Climate Change Act is a good idea or not. If you decide to have a unilateral policy, then you are going to have unilateral costs. It is inescapable. It is true that—

Lord Burns: How much does the fact that we have a unilateral policy, by comparison to other people, add to the cost?

Professor Dieter Helm: I should know this off the top of my head, but I do not. I forget what the current carbon floor price of carbon is, but it is a hell of a lot north of the €5 to €6 that is the price of the EU ETS, so it is quite a premium. But there are some exemptions on this stuff, which goes to the next point. If you take an economy that has much more substantive industry and yet has many policies that are like ours—Germany's—Germany makes a very clear decision; it charges the consumers an enormous amount of money and exempts the industrial sector from paying for these costs. The marginal cost, which is that the wholesale price is falling, is what German industry pays. It is very competitive. All the costs of the windmills and solar panels, and so on, or most of them, have been heaped on to domestic customers in Germany, who have among the highest electricity bills in the developed world. I doubt British consumers would tolerate that, but these are system costs, so there is a choice of how you do that. You cannot escape the totality of the costs, but you can work out which bits of your industry are most exposed in economic terms, which bits are price elastic or carbon price elastic and which are not, and the Germans are much more sophisticated about seeing off the consequence of their industry and what they have done.

Lord Burns: Going back slightly, I have one other question. You talked earlier about having the auction for capacity. When one does that and you put in a margin that you want, say 20%, so you auction for 20% more, what is the decision process about which of that is used, and do the people whose capacity is not used get paid the same return as the people whose capacity is used?

Professor Dieter Helm: As to the difference between capacity and energy, capacity is the payment for having the capacity available—not used.

Lord Burns: It is a two-part tariff, basically.

Professor Dieter Helm: Yes, but with the CEGB, for most of the 20th century you paid a capacity and energy charge. It used to be called a standing charge, and we used to pay it for

water as well. So you pay for the insurance that when you press that switch the light will go on, and you pay for the electrons that are coming through when you turn the light on. It is a perfectly rational way of doing it. As I say, in the Lawson world we had excess supply and nobody cared about capacity because we had far too much, so you just had an energy price. Actually, we had a capacity market at privatisation. It was terribly badly designed. We abolished it and created a single unified energy market under the so-called new energy trading arrangements—NETA—and then it became BETTA, I think, in Scotland. Now we have reinvented a capacity market back on top and the FITs.

The broad idea of having an energy market and a capacity market is enormously sensible, but it is one thing to have sorted out the categories; it is another to design the market correctly in the two components. That is the problem.

Q10 Lord Turnbull: If you are going to base your policy around the main instrument of a carbon price, you need a carbon objective.

Professor Dieter Helm: Yes.

Lord Turnbull: Roughly a decade ago we came up with the idea that that carbon objective should be 60%, and in the Act it was put at 80% below 1990. Allowing for growth in GDP, that means that each unit of production will have to produce 5% of the CO₂ that it used to produce in the base year. This is very ambitious, and the first question is: do we have the technologies to do that, or are we trying to do it with very clumsy instruments and we should be a bit more patient?

The other point is that a lot has happened in that decade. Temperatures have not gone up quite as much as people were proposing, but in particular we are now entering a post-Paris world in which none of the three major producers is subject to any binding limits on CO₂ emissions. Why are we crucifying ourselves in this way to make no difference whatever to world temperature, and why can we not take it in slower time and spend the time on developing newer technologies and in the meantime rely heavily on gas, which gets you about half the benefit but at a much lower cost?

Professor Dieter Helm: There are lots of different points conflated together in that question. The first question is: should you adopt a target if you do not currently have the technologies to meet it? To which the answer is: it is perfectly okay, provided that the target is quite a long way in the future. We adopt targets, in military terms, to beat certain planes in the air that we do not have the technology yet to beat, but we develop the technology to get there.

My take would be that we are at least pregnant with a whole range of technical developments that are perfectly theoretically capable of cracking our problem. I do not think that the—

Lord Turnbull: It is 34 years, not just—

Professor Dieter Helm: No. We are talking about 2050 targets to start with, and we are talking about a world in which we are trying to achieve, say, a 2-degree maximum temperature rise. Do not ask me about the science about 2 degrees, but if that is what you want to do and you set a target to get yourself to that point, on the question whether you have the technology to get there, even if you do not it still might be a reasonable target. But if you wish the end you have to wish the means. The means is that you need a serious R&D policy to get there. My critique of what we have done in current renewables is based partly on the idea that it has taken up enormous sums of money, some of which could have been spent on the R&D to develop the new technologies, which will give us an edge.

If you spend £10 billion on offshore wind, remember that £1 billion on an R&D programme is an enormously big R&D programme. We found £63 million to develop graphene and tens of billions to develop more offshore wind farms. So there is a balance issue in that. That is the first question.

The second question is: should you do it unilaterally, given that this is a global problem? It is a quite complicated political, economic and moral question, because, remember, we may not contribute much by way of emissions now, but we are responsible for quite a lot of the stuff that is up there already, and there are ethical questions about helping other countries to develop while richer countries take more burdens. I make no judgments on these issues, but they are all up there.

Then there is the question of the transition on the unilateral target. If you wish the end of the unilateral target, you have to wish the means. People complain about the carbon floor price, for example, but that is the most efficient way of achieving the objective. If you do not like the carbon floor price, be honest that you do not want the target rather than pretending you do not like the price.

Then there is the third question, which is the transition. What should we do now, given that is where we want to get to? I have always argued, especially in my book *The Carbon Crunch*, that the priority is to get out of coal and switch to gas, because that is a cheap way of

reducing emissions very quickly, and the other consequences of burning coal, apart from climate change, are really bad.

Until 1990, coal used to be the third largest user of electricity in Britain. It is incredibly energy-intensive. Every coal mine leaks methane. Everybody who goes down a coal mine has their life shortened, some of them substantially, and some of them gain lots of health problems before they die; we have seen the evidence of a swathe of people who suffer from these things. When a coal mine floods, it is usually in the water near the surface and there are serious mineral leakage problems for water supplies. You then transport this bulky product all the way to a power station, which is amazingly energy-intensive. It sits outside a power station—and coal is pretty radioactive, by the way. The one outside Didcot used to be more radioactive than Sellafield. It decays quite substantially. You then burn it in a power station, which loses most of the thermal efficiency of the stuff, and then you put the particulates—the PMs—and everything else, the SO_x and the NO_x, into the atmosphere. You use a huge amount of water to cool the stuff down and get rid of the ash.

If you want a policy that has no regrets, do not do what the Germans and the British do, which is make a dash for coal while you are pretending to decarbonise. The Germans have built 13 gigawatts of new coal since the mid-2000s, some of it involving opening new lignite coal mines. Thank goodness they are retreating, but we drove our coal consumption back up to 40% of the electricity system in the peak of the Miliband, Huhne, Davey years while we were pretending to decarbonise with our wind farms and solar panels—bad policy.

Lord Turnbull: But what we have done since then with coal: in May there was virtually no coal burnt at all.

Professor Dieter Helm: Brilliant. Finally, there is a good energy policy.

Lord Turnbull: Suppose you had your pro-gas policy but you kept the carbon floor price closer to what competitors have. By how far would we then miss the CO₂ target?

Professor Dieter Helm: That is not an easy question to answer.

Lord Turnbull: That is why I asked it.

Professor Dieter Helm: There are quite a lot of variables here, and you have to make assumptions about each of them to arrive at the answer. One of the big unknowns is demand. The lights are still on today not because we got by, by the seat of our pants, through careful planning. It is because we lost 20% to 25% of GDP. We declined 6% and then we grew at nought for several years. If you go back to the last plant and investment cycle,

which is 2006 and 2007, if we had not had the crash, and the growth rate had carried on as normal, I made the forecast back in 2000 that by 2011 we would have serious problems with the lights, which we would have done. Even with the economy performing so badly, we still can only scrape to 1% capacity margin at the end. This is really serious stuff.

If you think there is another crash on its way, if you think we have not yet sorted out the aftershocks of the 2000 crash and the end of the great late 20th century cycle, if you think the debt is piling up, you will have a demand forecast that will be very different in emissions consequences from elsewhere.

Then you have to think about what is happening in transport. We had this great environmental policy to have everyone driving diesel cars. Then we have all the emissions and things to deal with that. We have the question of the speed with which urban transport systems take up some of the slack. Then we have all sorts of questions about the performance and scale of some of the other renewables on the system, and you do not know whether Hinkley is going to arrive or not on to this.

The truth is that I cannot give you a straight answer to the question. I can tell you that we are where we are, we are getting out of coal, there is a very big hole, and there is only one thing that can fill it anyway. So regardless of your question and regardless of the outcome in CO₂ emissions, we have only one option in the next 10 years, which is that we will have to build quite a lot of gas power stations.

Lord Turnbull: I have one comment on that. If the uncertainties are that great, why are we setting a carbon budget in the mid-30s?

Professor Dieter Helm: Because we have decided, democratically, to pursue a unilateral carbon target and to legislate the means to the ends of achieving that in so far as we have decided to specify in five-year chunks what needs to be achieved. It is always for Parliament to reject the carbon budget, but it has to come back with something with the same effects, but it is also open to Parliament to amend the Climate Change Act. That decision has been made. As I said, the justification for that is quite complicated. It is about moral issues, international equity, legacy issues and the contribution that the UK can make. It might turn out to be a very good spur if we get on with the new technologies and the R&D, and exploit the opportunities that are available to us.

Q11 Lord Lamont of Lerwick: Going on to energy efficiency, I gather you have expressed the view that some of the initiatives taken there were less effective than a simple increase in

price would be and that the target rates for returns of 8% did not take sufficient account of the costs of adapting the elderly British housing stock. Is that right?

Professor Dieter Helm: Yes, broadly. The Green Deal was an extraordinary waste of money. I do not know how many houses did the Green Deal in the end. You need more than a few hands to collect them, but that is about it. It was extremely badly designed. It was unsuccessful both because of the design of the policy and because of the policy assumptions that lay behind it. Remember that everyone was going to rush out to do energy efficiency because the oil and gas prices were going to double. The net present value of the improvements was going to be enormous, and since the net present value was going to be so great because these oil and gas prices were going up towards the ceiling, of course even borrowing at 8% to do this and tying it to the household, which was quite a clever move within the policy framework, was never going to produce the result.

Then there were the ludicrous ideas, which were mainly elaborated during the Huhne period, that this was going to be done street by street and create 250,000 jobs; that is from one of the press releases that Chris Huhne delivered. You wonder how the relationship between these ideas and reality was squared. I quite like the draughts in my house because I find it very unhealthy not to have the air circulating and do not want to suffer from respiratory and other diseases. I like fresh air. When they get half way down my street doing the houses, I am going to say no, so then you cannot do it street by street. This idea that you just go into a town and do each street assumes that you own the houses and that you can force people to do the outcomes. That was the first illusion.

The next illusion is that energy efficiency reduces energy demand. Economics 101 says that if you reduce the relative price of something, which is what energy efficiency does—it makes it cheaper to have a certain level of warmth—the substitution effect is always negative: that is, the demand will go up, and it has done for 200 years. If you want to reduce energy demand, that is different from improving energy efficiency.

Finally, a number of studies suggest that there are massive savings to be made from energy efficiency investments; just get them in, do your roofs and things, and you will save enormous amounts of money. This is the £20-on-the-street argument. There are all these £20 notes lying around and people are too stupid to pick them up or they just need a bit of information to pick them up. Maybe they are just not there. Think of the practicalities of organising the Green Deal: turning up at someone's house and doing the installation. The

housing stock is pretty old in Britain. It usually that means the skirting boards, the carpets and the floorboards have to come up. You have to be there when the builders turn up. They have to turn up. They have to do what they are supposed to do. There are not going to be any ancillary costs, such as redecoration and all those kinds of things. Most people know rationally that the reality of doing this is not some spreadsheet calculation by a civil servant but the hard-core facts of life if you have major things done to your house. My take on this is that I am not the slightest bit surprised that the take-up was very low, and I am not the slightest bit surprised that it did not have much effect.

I am totally in favour of energy efficiency. By definition, it is a good idea; it is economically obvious. If the costs are greater than the benefits when all the costs and benefits are taken into account, and it genuinely has a positive net present value, who could be against it? But why would it not happen anyway? Most energy efficiency policies have never been genuinely about energy efficiency, except the Green Deal. They actually fuel poverty policies. If you are interested in fuel poverty, you do not want to reduce the consumption of the poor; you want to make it more affordable so that they can increase their demand for energy to have warmer and better facilities to enjoy the basics of life at least.

Q12 Lord Sharkey: Professor Helm, I do not think I have ever heard such a forceful and extensive description of such a terrible shambles, apart from the Labour leadership elections.

Professor Dieter Helm: You should visit Germany.

Lord Sharkey: That may be difficult in the future, of course. I want to ask you a simple question, which is Lenin's question: what is to be done? Is it not time at least to start by reinventing the equivalent of the CEEB?

Professor Dieter Helm: Let me answer in two parts. Lenin's question is always a good question to ask, but I also ask: what will be done? What should be done? Electricity is not rocket science; it is some wires, some power stations and a pretty stable and predictable demand. It is not like trying to design the latest model of a car. It is the same stuff. It is homogenous. All we need to do is make sure that we have enough power stations on our system, that we have a reasonably competitive market to sort out that these things are run efficiently, and that customers are not exploited or otherwise abused so that they can have reasonable electricity bills and they do not have to spend their nights on the computer working out the latest complex deal offered by whichever energy company it happens to be.

People just want a standard variable tariff that charges a reasonable margin and passes through the wholesale cost and the fixed costs that they have to pay.

Once you start with the basics of what you want, it is not very hard to design a market that works. You need a unified capacity and FITs market, you need a functioning wholesale market for the residual, and you need a sensible set of infrastructure for the transmission wires, distribution stuff, and so on. To do what you need to do is not very difficult. Why is it so difficult and why is it not done? First, there are massive vested interests in all the subsidies and policies that are put in place. I have written about this elsewhere, but once you start intervening in a market it produces unintended consequences. That produces more interventions and that produces more unintended consequences, which is why when we started this discussion I pointed out just how massively complicated the system is. Nobody deliberately made it complex. It is just that every Secretary of State added another couple of mechanisms. Every one of those mechanisms is capitalising some business or custom, and they lose if you take it away. It is like trying to reform the common agricultural policy; it is all capitalised in the land prices in the case of the CAP. You have lobby groups for the renewables. They will put someone up immediately if you say anything critical of them and then they will hit social media. That is what they do. You have the nuclear lobby, and you now have the fast-response business lobby. They are all involved in this together, and to sort this out you will have to impose losses. There will be genuine losers among the players.

What will happen is this. In my previous studies of energy policy since 1979, I came to a very simple conclusion that energy policy never changes until after a big crisis. You need a big enough shock to make people accept the losses and go back to some first principles. Nigel Lawson did it, but that is because the overhang was so colossal and the state owned the assets. We are tinkering, so we will have a capacity auction in the autumn, for example. It will not produce the right result and it will be very expensive. We will have a fundamental review in January. We will have a new consultation document in March. We will run another auction and it will not work properly. We will have a fundamental review the following January and have a revised proposal the following March, and we will do it again. We will do that every year for 10 years and keep intervening in these prices until something seriously goes wrong.

The incremental problem is not serious enough to get people moving. After all, you can overcharge—the Competition and Markets Authority does not use the word “overcharge”—

or have a market inefficiency that 70% of people are paying £1.4 billion more than they need to for their electricity bills because they are too ignorant, too stupid or too lazy to switch, and if we have a database that will solve it. I would have thought that is a big enough item. Wholesale prices have fallen 35% since Ed Miliband made his speech about freezing energy prices. Retail electricity prices have gone down not one iota to reflect that massive cost fall, but the Competition and Markets Authority thinks that is fine, or at least it thinks that it is solved by switching, because these consumers must be persuaded to do these things.

On the capacity side, if you had asked me at any time in the past two decades whether the capacity margin getting close to zero would create a crisis and something would happen, I would say yes. I have learned about the resilience to this. It is not a big enough problem yet. It will be and then we will get a different policy, but we will pay a lot of costs before we get there.

Q13 Lord Forsyth of Drumlean: That is very cheerful. Can I ask you about North Sea oil and gas? Ian Wood said in his report that the UK had to regain its position as an attractive destination for exploration funds from large and small companies alike. What do you think the prospects are for the North Sea?

Professor Dieter Helm: There are several dimensions to this. The first dimension is that world prices have fallen back to what I regard as normal, and my own view is that they will probably carry on falling very slowly for the next two or three decades, as they did for 100 years between 1870 and 1970, through the whole of the last century. The question is a rebase. A North Sea based on \$100 and \$110 per barrel is a completely different place from the one based on between \$40 and \$60 per barrel. There are lots of players out there who have various predictions of what they think is going to happen and will have to adjust their business strategy to work out whether this fall-back is temporary or permanent.

Secondly, there has been massive technical change. One of the big effects of shale technology is not on shale deposits; it is on conventional wells. You can do all sorts of drilling around wells. Most oil wells in the world never get to 50% depletion before they are abandoned; it is just that the pressure has gone and it is not worth getting the stuff out. These technologies expand the capacity of what you can do with existing wells very substantially. I think there is a lot more scope for getting stuff out than is currently thought to be the case on existing technologies.

Lord Forsyth of Drumlean: How do we exploit that? What do we have to do?

Professor Dieter Helm: You create an environment in which these technologies are applied.

Lord Forsyth of Drumlean: Is that a tax policy?

Professor Dieter Helm: The third point is tax. The first point is about the price of oil and what you think the price is against the costs of extraction. The second point is that there are lots of technical possibilities now. But the third point is tax. Taxation is the dominant cost in this sector, in effect, at the end of this process, and we have to cut a fiscal cloth that plucks the golden goose but does not kill it. That is a choice that you want to make. Of course, there is a meta-problem, going back to the earlier question, which is that, if you are so hell-bent on eliminating fossil fuels and doing your stuff for climate change, you might abandon it. But if you genuinely want to think about it as an economic prospect to get the resource out, you will have to change the tax policy. The R&D and the technology costs are all about tax and how the treatment of R&D and investment costs work and the offsets against the tax. As to the price, there is nothing we can do about the global price and people have to adjust. My guess is that it will turn out to have a much longer tail than people imagine, because all the projections are done on existing technologies, not on the application of new technologies.

Lord Forsyth of Drumlean: Even allowing for the decommissioning costs, you think it is possible to have a tax regime that will exploit those resources.

Professor Dieter Helm: Suppose the tax was nought, with full investment allowance for investment. I am not proposing this, but suppose it was. Obviously, it would be a completely different industry from the tax rates at the moment and the treatment of investment costs and what they are. It is a choice.

Lord Forsyth of Drumlean: Do you accept that the decommissioning costs would then look relatively more expensive?

Professor Dieter Helm: The decommissioning costs are important. We rightly insist that the nuclear industry has proper ring-fenced decommissioning funds, but the oil industry does not. It is quite wrong and we should not bail them out for it. When Shell or others say that it is very expensive to do this, you know what the OSPAR agreement says. We do not expect EDF to turn round and say, "It is terribly expensive to decommission and we have not provided enough money for it. Could you just let us off please?" It is a principle. The higher the decommissioning costs, by the way, the longer they will keep the wells going. It is like nuclear power stations, but I think it is a separate issue and a serious environmental issue that ought to be addressed.

Q14 Lord Forsyth of Drumlean: I have one other question, which is based on anecdotal stuff, and you are very expert in this area. You were talking about the very high cost of offshore wind and other renewables. One complaint that one hears anecdotally, particularly for hydro schemes in Scotland—and, I dare say, elsewhere—is that, leaving aside the issue of the tariffs that are paid, the actual cost of getting a scheme up and running and connected to the grid, with the barriers and the costs that are put in people’s way, makes these schemes very difficult for private suppliers to operate.

Professor Dieter Helm: Yes, but, as with the offshore-wind industry, of course it is always in their interests not to pay the system costs of what they are doing. You hear these quotes of offshore wind coming down from £160 per megawatt hour to, let us say, £100, somewhere near the Hinkley number. But what about the transmission costs? What about the back-up to the system requirement? In my unified capacity auction, everybody would bid firm power. If you are intermittent, you would have to subcontract to solve your intermittency problem, and by the way that would encourage a secondary market and all these kinds of things. I do not know the detail of the particular hydro schemes, but they tend to be in remote places.

Lord Forsyth of Drumlean: The allegation is that the operators exploit their monopoly position on this and say that the costs—

Professor Dieter Helm: That may or may not be true, but work out what you are building a hydro for. If you are building it as a peaking station, such as Dinorwig, then it should compete against little gas peakers, batteries, all sorts of other stuff—smart meters, demand-side measures. That is why we need to develop the market—to see which are cheaper. If it is to provide base electricity, such as the tidal booms, that is a different issue. All these investments for a given system change the configuration of the system, and because they change the system characteristics those costs should be included in their costs. Offshore wind is not £160 per megawatt hour; it is £160 per megawatt hour, or whatever, plus the rest, and you get this absolutely understandable lobbying to try to shift those costs on to someone else.

The Scots do not want to pay the fully locational transmission costs of the national grid. That changes the cost structure for renewables in Scotland, and quite a few of them, if they had to pay the true costs of the transmission, would not be there. I do not know how your hydro scheme, or whatever else, fits in that frame, but there is an important point about having a system view of costs. You read in the papers, “We have brought this thing on and it is going

to heat or power 1,000 houses". When? How much of the time? For what period? Compared with what? These are all considerations.

I have an aside to make on the quality of journalism reporting this stuff. They just trot out the press release that the organisation sets out. Everyone believes it, but it is obviously not true.

The Chairman: In the last few minutes, we have one more question.

Q15 Lord Layard: I want to ask about imports of electricity and how that may in the future alleviate some of these knife-edge problems of capacity and the lights going out. What is the scope going to be for that? Maybe it is even more economic to import from France.

Professor Dieter Helm: There are two different points to that. The first is: is interconnection security-enhancing? The answer is that they are both parties. If you wire up countries across Europe, the ability to absorb differences in weather patterns, demand shocks and power station failures is greater. In general, interconnection is a good idea. We used to have a power system for Oxford. Then we had a regional system, because we interconnected. Now we have a national system, and then we interconnected with Scotland and expanded it. That is a good thing.

The characteristics of the different interconnectors are very different. You might think that the new proposed interconnector with France would bring nuclear power into our system—more low carbon. No, it does not. It sucks in more coal into the coal generation into France, which meets the peak that goes down our system. It actually turns out to be coal-generated at the margin, which will come via our interconnector from France.

The Norwegian one is quite different. Norway is very hydro-based, and utilising Norwegian hydro as a way of decarbonisation in Europe is quite a good idea and has lots of very reliable system properties.

The Icelandic connector—it depends on the technology, but again if the technology of connectivity and under-sea cables improves—provides a different kind of energy on a baseload, a different kind of provision. That is fine.

Will this solve all our problems? Just think of an interconnector as the equivalent of building a power station. Which is cheaper? Then think about which one you control, what their system looks like and how reliable it is. It might be better to build two CCGTs than interconnect to France, or it might not. I think of an interconnector as a little cable with a power station at the end. Then I want to know the characteristic of that power station, its

reliability, what backs up behind it, its security of supply system, and so on. It is quite complicated, but who could be against an interconnector if it is economic?

The Chairman: Professor Helm, thank you very much for a very informative and absorbing session. I know that you have to get away. Thank you very much for spending so much time with us.

Professor Dieter Helm: Thank you very much.