



Select Committee on Economic Affairs

Corrected oral evidence: The Economics of UK Energy Policy

Tuesday 1 November 2016

3.35 pm

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Members present: Lord Hollick (The Chairman); Baroness Bowles of Berkhamsted; Lord Burns; 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.

Evidence Session No. 5

Heard in Public

Questions 61 - 86

Witnesses

[I](#): Mr Vincent de Rivaz, Chief Executive, EDF Energy, Mr Paul Spence, Director of Strategy and Corporate Affairs, EDF Energy, and Mr Humphrey Cadoux-Hudson, Managing Director of Nuclear New Build, EDF Energy

[II](#): Mr Peter Atherton, Associate, Cornwall Energy, and Mr Tom Burke, Chairman, E3G, Third Generation Environmentalism

[III](#): Mr Tom Samson, Chief Executive Officer, NuGen, and Mr David Stearns, Business Development Director, Horizon Nuclear Power

Examination of witnesses

Mr Vincent de Rivaz, Mr Paul Spence and Mr Humphrey Cadoux-Hudson.

The Chairman: Gentlemen, welcome to the House of Lords Economic Affairs Committee. As you know, we are currently looking into UK energy policy. We have a few questions for you this afternoon. Monsieur de Rivaz, I believe that you have some short remarks that you wish to make.

Q61 **Mr Vincent de Rivaz:** We are delighted to be here with you to answer all your questions on Hinkley Point C. Indeed, it is a project that has benefited from a lot of independent scrutiny over many years.

As well as looking at the details, important as they are, for Hinkley Point C, we all need to put it in the context of the bigger picture. My strong conviction is that industry and government share the same goals. We have a common enemy: climate change. We are fighting climate change. We have a common purpose—security of supply—and a common goal: to achieve all of that in an affordable way. The context is that we all need to consider that meeting those goals means working together, rather than having different interest groups fighting one another, each claiming that its technology will be able to provide all the answers. This is not our view.

We cannot cross our fingers and hope for a future, not-yet-proven technology to meet our needs, without any idea of how much it will cost and when it will be commercially viable. We need renewables, gas, storage, interconnection, batteries and nuclear to meet our energy needs, to fight against climate change, to get security of supply and to do so in an affordable way. It is my conviction that there is no single technology as a panacea.

I think that is why we have been successful after many years, despite all the odds, at Hinkley Point C. This country understood many years ago that without nuclear we would not achieve our goals. I am very pleased to be here with you this afternoon with Humphrey, who is the managing director of new nuclear build, in charge of Hinkley Point C, Sizewell and Bradwell, and Paul Spence, who is my strategy, public affairs and regulation director.

My last point is on the price—referring to the strike price. It is important that you look at the current, slightly depressed wholesale prices. By the way, we are seeing interesting or significant moves in the power price at the moment. When we want to value the strike price between 2025 and 2060, which is the price in the contract for difference, we must all be modest about it, but we have no problem comparing that strike price with what might be the alternatives.

It is also true that customers in this country will not pay one single penny before we have achieved these plants in 2025. All the risks of

construction are borne by us as investors. The question of the rate of return as a consequence of the contract for difference has been scrutinised many times, including in Brussels. I know for a fact that they were not complacent about it. The case was examined and made public by the Government in their value-for-money assessment. I fundamentally believe that the deal is a fair deal for the investors and a fair deal for customers. It is the only way for a deal to be sustainable.

My colleagues and I are happy to discuss all those points with you through your questions and our answers.

Q62 The Chairman: Thank you very much. We will want to follow up on many of those points. Can we start off by understanding the timetable? What are the key waypoints on the timetable? My second question is about the costs and why they have increased so dramatically over the last period. In the original estimate, the strike price was £50. Of course, we have now ended up at £92.50. I have those two questions—on the timetable and the costs. It would be helpful if you or your appropriate colleague would lead us through that.

Mr Vincent de Rivaz: My colleagues will chip in. The timetable is crystal clear. We have a target, which is to deliver the first kilowatt hour—the first unit—from Hinkley Point C by the end of 2025. That is what we said last year. I am pleased to confirm it.

On the strike price, we have heard some people suggest that it should be £130. We have seen all sorts of figures, which have sometimes been elaborated by individuals or organisations that are not very interested in the reality check. The price of £92.50 was negotiated in 2013. It is based on a cost estimate of £18 billion, which has not changed since then. Never, never, never have we contemplated a strike price of £50 per megawatt hour. I know for a fact how we negotiated this deal with the Government. Of course, we did not agree on the strike price at the first meeting, but basically we have landed exactly where it was logical to land.

After the deal was negotiated, it was scrutinised by Brussels. They looked at two elements, as the British Government did, during the negotiation. First, what is the cost? Is it justified? How did we build up the costs? They concluded that it was a justified cost. Secondly, what is a fair return? The return is 9%. There has been a long discussion about the risk/reward. Recently the Chancellor said, rightly, that the return of 9% is a sensible number, given that all the construction risks are borne by the investors. In 2014, Brussels agreed on that.

In 2015, we had a new layer of scrutiny, when we invited our Chinese partners to invest £6 billion in this project. It found that the contract was indeed balanced. In the end, the fact there have been so many scrutinies, on the same topics, probably means that we have the right balance in this deal.

The Chairman: On the timetable, when will the final investment decision

be taken?

Mr Vincent de Rivaz: It was taken on 29 September. I remind your Lordship that on 15 September—contrary to many promises that this project was dead in the water—the Prime Minister confirmed that Hinkley Point C should go ahead. On 29 September—14 days later—450 contracts were signed. Two hundred thousand pages of contract have sealed the deals between us and the UK Government, us and the Chinese investors, and us and all the major contractors. It is all done. The project is going on.

The Chairman: Presumably, one important part of this is getting all the financing in place. When do you anticipate that that will be done?

Mr Vincent de Rivaz: It is in place.

The Chairman: It is.

Mr Vincent de Rivaz: Absolutely. It was an important feature of what we had to do—crucially, at the beginning of January. For my main shareholder, EDF Group, there was a challenge to strengthen the balance sheet, to allow the huge programme of investment that EDF is planning, both in France, and the UK and elsewhere, to be affordable. There was a long discussion with the shareholders of EDF, leading to a solution based on three key elements. The first is reduction of costs, as all companies have to do when revenues are going down. That is the case because wholesale prices are so low. The second is to have a plan to dispose of non-strategic assets, to the tune of €10 billion by 2020. The third is to increase the capital of the company by €4 billion. That is added to the fact that the French shareholder has accepted being paid its dividends in shares. The financial strength of EDF to invest £12 billion in Hinkley Point C was therefore secured in the spring.

As far as the Chinese are concerned, at the end of 2015, they agreed to invest £6 billion in this project. The financing is in place. The money is already flowing from EDF and from China to the project.

The Chairman: So the financing is not dependent on any changes in market conditions or anything like that.

Mr Vincent de Rivaz: No.

The Chairman: I go back to the overall cost. You said that there was a 9% rate of return. I infer from that that, if the rate of return has remained constant, the variable has clearly been the capital cost of the project. The fact that it is has gone up from £50 originally to £92.50 reflects the increased cost of the project.

Mr Vincent de Rivaz: I do not know where the figure of £50 comes from. I can tell you that the negotiation that we had with the Government in 2013 never, never, never contemplated that sort of figure. Later you will receive evidence from Peter Atherton. He advocated a figure to the

tune of £130, which I thought was ridiculous as an expectation. We have landed at £92.50.

The Chairman: The figure of £50 was an estimate that you gave the Government in 2009.

Mr Vincent de Rivaz: No. We did not give any number to the Government, Nick, based on Hinkley Point C. The reality of the project was developed from 2009 to 2013. I remind the Committee that we were very active during that period in securing from the safety authorities of this country, for the first time, a generic design assessment for a third-generation reactor—the safest in the world. That has been certified by the safety authorities. We could not give any number for the costs without having the design stabilised through that process. During that period, we also did something that has never been done before: in a very short time, through a new planning process, we secured the planning consent—the DCO. We got that in March 2013. From that, we started to put in front of the British Government the numbers for how much it would cost and what the strike price would be.

The Chairman: Are you saying that the numbers did not creep up during that period?

Mr Vincent de Rivaz: No.

The Chairman: I see.

Mr Vincent de Rivaz: I know very well what Nick's constant position has been all these years—including the comment made at the end of July that the project is dead in the water. The reference that he probably has in mind is based on something totally different.

Q63 **Lord Layard:** Could we continue with the issue of value for money, which you touched on in your remarks? There are various issues in that. First, what is your estimate of the cost of alternative ways of delivering low-carbon energy? I refer to the comparisons that you mentioned. Could you give us a bit more on that? Secondly, what do you think the top-up payments will be between the strike price and the market-clearing price?

Mr Vincent de Rivaz: The first question is about the cost of the alternatives, as we and the Government foresee them—from 2025 onwards, which is the right period for comparison. Paul will address that.

Mr Paul Spence: As I am sure you know, the Government have looked at a number of different alternative options for Hinkley Point. They have looked at whether it could be replaced with gas generation or renewable generation, whether that is wind or solar. In both cases, they have produced, as part of their value-for-money analysis, work that identifies that Hinkley Point is competitive with the range of possible outcomes.

I will give an illustration, if I may. Today, when we look at Hinkley Point, we are talking about a project that will provide 7% of the UK's need for electricity in 2025. We also have 34 contracts for difference already

agreed by the Government, as part of the renewables programme, which will provide about 7%, in total, of UK electricity need. On average, those 34 contracts for difference will cost consumers £120 or £130 per megawatt hour. By contrast, Hinkley will cost consumers £92.50 per megawatt hour. Against that alternative, which is a mix of onshore and offshore wind, Hinkley Point is cost-competitive.

Against a comparator of a CCGT, or a suite of CCGTs, the two fundamental questions become: what is the cost of the gas that might be burnt in those CCGTs, and what is the cost of the carbon dioxide that might be emitted? Again, the Government have done the work of looking at the potential range of those costs. Again, they have said that Hinkley Point, at £92.50, compares favourably with those costs. There are scenarios where the cost of the gas stations may be lower, if gas prices stay low. However, in that world, the reality is that we will not meet our objective of decarbonising the economy. There will be more action, which will cost more elsewhere. The Government have concluded—from what we have seen of their analysis, we support it—that the most cost-effective solution, for the total system cost, is a solution that has nuclear as part of the mix.

There is another thing that I should add. If the Government had concluded that it was a solution that involved the use of intermittent generation, whether wind or solar, as an alternative, we would have needed to make sure that there was either storage or back-up generation in place and the grid would have needed to be larger. The net result of those measures is an additional cost of about £10 to £15 per megawatt hour that is required on top of the strike price that consumers will pay for the generation. All in all, that is why we believe that Hinkley, at £92.50, is a good, first-of-a-kind deal for the UK.

Q64 Lord Turnbull: Many people, myself included, are disappointed with the outcome. We were told that there was, in your words, a settled and approved design, that it was the safest and that the design was established, so the risk that had plagued a lot of previous projects should have been eliminated and it was now simply a question of building it. The question is that you do not seem to be able to build it. It is taking much longer, and there seems to be a lot of uncertainty about whether you can in fact build it to the timetable. If the design is settled, why is it taking you so long to build the existing two projects of this design you are working on?

Mr Vincent de Rivaz: I will give you good news. The two EPRs that are built at the moment in China are about to start their commissioning phase, with the so-called hot functional tests. Can you imagine for one second that the company building those two EPR reactors in China, CGN, would invest £6 billion in two EPRs in Somerset if it was not fully confident about the technology and our ability to deliver?

The Flamanville project in France has indeed faced a lot of challenges. We can spend a lot of time on those; I am ready to elaborate on them. It is now set up to succeed. The commissioning will take place in 2018.

Basically, we cannot deduce from the initial cost and schedule that we set at the start of Flamanville that there are some weaknesses in our ability to deliver Hinkley Point C. At the time when that decision was taken, the design was not stabilised, the organisation of the project was not in place and there was a clear underestimate of the cost and the schedule.

We are a learning organisation. We have learnt the lessons in the cost and the schedule for Hinkley Point C. We have taken into account the reality of the costs of having built the Flamanville EPR in France. I will let Humphrey, who is in charge of NNB, elaborate on why we are convinced that we will deliver Hinkley Point C on time, on budget and safely—on why the teams are ready and on what we have done as regards innovation for this project to set it up to succeed.

Mr Humphrey Cadoux-Hudson: In summary, we have put together a very detailed project plan, covering tens of thousands of steps. That has been reviewed by our shareholders and the Chinese. We have also had a number of independent experts come in and look. More importantly, the elements of that schedule have been signed on to by our supply chain, which has gone through the civil and mechanical erection phases. We are building some sections of the plant in mock-up, so that the teams can train on building. That is needed in the UK, because we have not built this sort of equipment for a long time. We have gone to an enormous amount of trouble to make sure that in the 3D model—what is called a 4D model—we have built the plant bit by bit, together with our supply chain, so that we can demonstrate that the sequence, timing and effort required to build the project on time and on budget have been put in place.

Lord Turnbull: Effectively, you are saying that you can build this thing better in Britain—despite the fact that we have not built any for years—than you can build it in France. I am not sure that I find that very plausible.

Mr Humphrey Cadoux-Hudson: The key to all this is that we are in a position, through the generic design assessment process we have been through and the lessons that we have got out of the other stations, to start with a complete design. It is a complete design whose planning we have now worked through with our supply chain. All of that is now reflected in a hugely detailed project plan running through to the end of construction. You cannot compare that state of readiness with the state of readiness at the beginning of either the Flamanville or the Taishan projects.

Mr Vincent de Rivaz: First, I do not want us to talk down Britain. In recent years, Britain has proven that large infrastructure projects can be delivered on time and on budget. The Olympics is one example. We have in our teams people who have been part of large construction projects in Britain that have been successful.

Secondly, the UK supply chain is of high quality. I know it for a fact, because they are our partners on the existing nuclear fleet. I would like to say something very simple. We bought the then British Energy at the

beginning of 2009. In its last year under the previous ownership, British Energy produced 40 terawatt hours. This year—2016—we have produced more than 64 terawatt hours, an increase of more than 60%. In the last seven years, we have increased the life expectancy of the AGR fleet by 8.3 years, on average. We have improved by a factor of two the safety performance of these plants. It is not all due to the fact that they have come under the ownership of EDF Energy—it is also largely due to people working in this industry, including in our supply chain. They have done a remarkable job. In the last period, we have invested £4 billion in our existing plants. The huge majority of that money has gone to the UK supply chain. It is a complete error to believe that the UK supply chain is not capable of delivering. In relation to that, we have put in place many innovations at Hinkley Point C, compared with previous projects. That makes us confident that Britain will succeed at Hinkley Point C.

Lord Turnbull: Can I ask you a question about the contract? You say that you do not get paid if you are not delivering electricity by 2025. Normally in a supply contract, if you have failed to deliver on time, the penalty is not simply that you do not get paid, as the buyer then has to make alternative arrangements, which may well be more costly. Is there some compensation built into the contract to allow for the fact that the UK Government will have to arrange alternative supplies?

Mr Humphrey Cadoux-Hudson: There is not direct compensation for the Government for alternative supplies, but there is a very strong incentive in the contract. If we are delayed, we carry the cost of an enormous construction investment for a period with no return. As the contract is delayed, its length will also get shorter. The contract has built in a very strong incentive on us to build on time.

Q65 **Lord Forsyth of Drumlean:** You are being very reassuring on Lord Turnbull's point about whether the technology works. I wonder why, when he resigned in March, which is only seven months ago, your finance director told a parliamentary committee in France, "Who would bet 60 to 70 per cent of his equity on a technology that has not yet proven that it can work and which takes 10 years to build"?

Mr Vincent de Rivaz: The CFO of EDF is fully supportive of this project. The individual whom you mentioned has left the company. It is his choice to talk down the company that he has just left. I will not comment further. He was replaced the day after his resignation by a CFO of high quality, who is highly respected and fully supportive of the project.

Lord Forsyth of Drumlean: Do you not think that it at least puts a question mark against whether the technology works if the finance director says that it is unproven?

Mr Vincent de Rivaz: I have told you that the finance director of EDF is fully supportive of the project. The shareholders of EDF are fully supportive of the project.

Lord Forsyth of Drumlean: Should I conclude from that that anyone

who casts doubt on the validity of the project will cease to be in office at EDF?

Mr Vincent de Rivaz: It is not like that. This project has been challenged and scrutinised and has been through many layers of approval process. It has been approved by the board of EDF, by the board of the Chinese company and by Brussels. It was approved by the new Government in Britain on 15 September.

What I can say about the technology is very simple. It is EPR technology. What does that mean? "EPR" stands for "European pressurised reactor". Let us forget the "E" for "European" and focus on "pressurised reactor". It is PWR technology. There are 277 PWR reactors working in the world. What has been done on this new design is an upgrade to PWR, to strengthen its ability to resist external events such as an aircraft crash on the plant. The technology of the reactor is the same. We are confident that it is safe technology and that it will work, as the 277 previous PWR reactors are working.

Lord Darling of Roulanish: I want to pursue that point. If your finance director was so fully supportive of the project, why has he left?

Mr Vincent de Rivaz: No. I am saying that the finance director of EDF today—

Lord Darling of Roulanish: No—the last one.

Mr Vincent de Rivaz: He has left.

Lord Darling of Roulanish: Yes.

Mr Vincent de Rivaz: He was not supportive. That is why he left.

Lord Darling of Roulanish: Are you saying that we should ignore the fact that he expressed severe doubts about it—on EDF, on the technical ability to deliver this power station and on the cost?

Mr Vincent de Rivaz: I do not ignore it. I am just saying that the board, after a long process involving the audit committee, the strategy committee and board meetings—hours and hours of discussion—approved the investment. The CFO—the chief financial officer of the group—is fully supportive of the project, with no reservation at all. There can be someone—it happens in the life of governments—who is in disagreement. Does it mean that the Government are wrong?

Lord Darling of Roulanish: Your last finance director clearly was not up to the job, in your view.

Mr Vincent de Rivaz: He has made a choice. It is his choice. He was perfectly free to have a different opinion. However, the current CFO is as respectable as the previous one.

Lord Darling of Roulanish: I am not asking about the present one; I am sure that he is fully signed up. Can you remind me of the date on

which Hinkley C will start to produce electricity for the grid?

Mr Vincent de Rivaz: It is 2025.

Lord Darling of Roulanish: When in 2025?

Mr Vincent de Rivaz: By the end of the year. Frankly, Alistair, I am not sure that I can give you the precise date nine years in advance, but it is the target of the project to deliver it at the end of 2025.

Lord Darling of Roulanish: I am asking you the question for a reason. I understand that the last finance director was sceptical that it would take nine years to build it. Indeed, that is what he said.

Mr Vincent de Rivaz: Nine years is—

Lord Darling of Roulanish: Hold on a moment. If you look at the two EP reactors in France and Finland, as I understand it, they are years behind schedule and are costing far more than was anticipated.

Mr Vincent de Rivaz: Yes.

Lord Darling of Roulanish: My simple question is: if that is the track record, and you are now saying that nine years out it is difficult to speculate about when this may be finished, how can we have confidence that we are starting on something that will deliver electricity at anything like the time that you say?

Mr Vincent de Rivaz: I come back to the track record. I told you very openly that the assumptions on which the Finnish and French projects were launched were flawed. There was a context at that time, on which I do not want to elaborate. The projects were launched, but they were not ready. The assumptions that were made about the costs and the schedule were wrong—dead wrong.

We changed our approach dramatically to prepare this project. We have a design that is stabilised and approved by the safety authorities, which was not the case in Flamanville. We have an integrated work schedule that was prepared by all the main contractors, well in advance of our signing the main contract. That was not the case in Flamanville. In this project, we have innovated by bringing in something that did not exist in Flamanville—3D and 4D tours. This project will be digital. It makes a big difference to be able to have the plans as built on your screen when you want to check that there are no clashes in the process of building the pipes, the wires and the concrete. That is a very important tool to secure.

We have something I personally am very proud of. We have secured with all the British trade unions what I call a new covenant—a social deal—that includes heads on all the questions of productivity, organising of works, pay, rewards, promotion, training, et cetera. That deal is binding on us, as the owner, on the unions and on all the companies that will have workers working on the site. I know for a fact that there are a few examples in this country where the productivity of construction has not

been great, to say the least. This is a fundamental element of innovation that will help to make a difference.

On the schedule, you talk about nine years. We have started this project. As your Lordships are aware, we have already invested £2.5 billion. It has been money well spent—in the GDA process, with the safety authorities, in the planning consent, with local communities, and in the engineering. When we start to build the reactor itself—to pour the concrete—in mid-2019, more than 70% of the detailed design will be ready. In previous projects, it was less than 30%. I can give you the list of dramatic changes, including learning lessons, that lead us to say that a period of nine years between now and 2025—78 months between the first concrete and commissioning—is neither too long nor too short. It is what the project will need.

Lord Darling of Roulanish: You said at the start that it is very difficult to project out nine years, despite all the things you have been through. This could be a project that is so massive that it reaches a stage where we cannot go back. If it overruns, we will be stuck with it. Is there any risk that EDF may have to come back to the British Government to ask for more money to complete it?

Mr Vincent de Rivaz: Absolutely not; categorically not.

Lord Darling of Roulanish: You are absolutely sure about that.

Mr Vincent de Rivaz: Yes. It is at the heart of the CFD. I have to say, “Well done, UK”. We are always talking things down. We have a champion of negativity in Nick Butler, who has been attacking this project all along. He has been wrong in all his blogs, which you can read in the *Financial Times*. What is Nick Butler going to write? Exactly the opposite of what he said was right.

The contract for difference is innovative and progressive. When we went to Brussels to defend it to a group of people who were not very pro-nuclear, they were surprised that Britain, the country that liberalised the energy market, was putting back regulation. We won the case, with the British Government. It is innovative. It is the first time in a large construction project like this that we have a deal where we, the investors, take all the construction risk. We are not going to ask for one more penny from the customers for that. The market risks are taken through the Government—through the strike price—and not by us.

That does not come from this Government or the previous Government, but the Government before the previous Government. When the policy for energy was discussed by people who were part of the Government, they thought that a bit of regulation—for a better market, not a lesser market—would be helpful. It is not possible to achieve the large capital-intensive investments that we need to fight climate change and to get security of supply without our taking the risks, but not all the risks—including the market risks. We have done that, to reduce the cost of capital. At the end, we have a strike price that is affordable.

Lord Darling of Roulanish: I am not anti-nuclear either. To be clear, you are saying that this power station will open before 31 December 2025 and that you will not come back to the British Government for more money.

Mr Vincent de Rivaz: I repeat: categorically, my answer is no.

Lord Sharkey: I want to ask a question of clarification. On what basis can you say categorically that you will not come back to the UK Government to fund completion?

Mr Vincent de Rivaz: There is nothing in the contract that would allow us to do that.

Lord Sharkey: It is not a question of allowing it. Is there a basis for you to say categorically that you will not ask for more money?

Mr Vincent de Rivaz: The construction cost is our cost. These are our risks. I cannot be clearer.

Lord Sharkey: I hope that you are right. It would set a fortunate precedent.

Mr Vincent de Rivaz: We are talking about the paradigm of the past. It is a first time. This is a progressive contract that did not exist in the past. It is a partnership. There are risks that we are taking and we are ready to take, because it is our job to build and to operate the plants. If we were taking the risk of the market price, the return would have to be much higher. In the end, the customers would pay more. The Government are not taking the risk of the construction, which explains why we still need 9%. That is the deal.

The Chairman: Could I jog your memory a little? In 2008, EDF made a capital markets presentation where it said that the price would be £45 per megawatt hour. It has travelled from £45 in 2008—that was a public statement by EDF—to £92.50. Over that period, which is the same as the build period, there has been dramatic escalation. Are you saying that you will take all the risk of further escalations over the next period?

Mr Vincent de Rivaz: I am sorry to be repetitive.

The Chairman: I just want—

Mr Vincent de Rivaz: I understand your question. At that time, there were flawed assumptions about the cost of Flamanville. Based on the cost of Flamanville, you have a number. That does not interest me. What interests us today is the cost of Hinkley Point C. Has it been scrutinised? Is it reliable? Is it something that we can deliver? The answer is yes. It has been scrutinised—one, two, three, four times. Are we organised to deliver it with our suppliers? The answer is yes. That is the cost of the project. The strike price is the result of the cost and the return—full stop. I am sorry, but it is a matter of the past to refer to something that is not the reference for the project.

The Chairman: The past can sometimes be helpful in understanding the risks of a project.

Mr Vincent de Rivaz: Yes. We have done that.

Q66 **Lord Livermore:** I would like to follow up on the question from Lord Turnbull. If the EP reactors in France and Finland are not completed on schedule, what risk does that pose for Hinkley?

Mr Vincent de Rivaz: First, they will be. Secondly, there is no consequence for Hinkley. They are independent projects. We are not aligning the schedule for Hinkley with those for Flamanville or Taishan. They are independent.

Baroness Bowles of Berkhamsted: If I get it right, you are saying that there have been problems with the reactors that you have been building and you have learnt a lot from that, so Hinkley will presumably go forward more smoothly, at least in so far as you have got with the ones that you are building. What happens if they run into further problems? Would it have been sensible to have waited until one was operational before starting on another?

Mr Vincent de Rivaz: Of course, if the delays had not happened at Flamanville, Flamanville would be up and running now, which would have avoided this type of question. However, we made a choice. It is our commitment to this country to go ahead with the project so that in 2025, when the country needs it, it will be up and running. It is our decision. It is our risk, and we are confident. The Chinese have taken that risk with us. I repeat: they are building two EPRs at the moment, so they know what they are talking about. They are not investing their money without knowing what they are doing.

The important thing is that we, as a team collectively, are ready to deliver on time and on budget. We have convinced our Board and a lot of people of that. Humphrey may be able to give you recent news of the progress that we have made.

Mr Humphrey Cadoux-Hudson: I can. It is worth reflecting on the fact that at Taishan, in China, they have completed construction of unit 1. Some time ago, they started the commissioning of the unit with what is called cold functional testing, which is testing of pressures. As Vincent said earlier, they are just about to launch what is called hot functional testing, which is where you test that the systems work and can move the liquids and other things around in the way anticipated in the design. You are not allowed to do that unless you can demonstrate that your plant is in a very advanced state of testing and completeness, so unit 1 at Taishan is very close to being finished and is entering the final stages of testing. At the end of that, the next stage is to load fuel into the reactor and to start it up. That is why CGN talks about starting the reactor midway through next year.

Lord Darling of Roulanish: Is the Chinese one identical to Hinkley?

Mr Humphrey Cadoux-Hudson: Yes.

Mr Paul Spence: You asked whether we could wait. As a company, doing what we do, we are very conscious of how much capacity has already left the UK electricity system since 2010 and how much more is projected to close over the next 10 years. Notwithstanding what Vincent said about the success that we have managed to have in extending the life of the 10 gigawatts of existing nuclear stations, to fill some of the gap, there is a looming gap. We need to fill that gap with low-carbon technology. Part of the decision to move ahead with Hinkley is about making sure that it is there when we need low-carbon capacity.

Baroness Bowles of Berkhamsted: That is assuming that we will still need the baseload when we get there. You have said that that assumption is made.

Can I return to the worst-case scenarios? I know that you are less interested in talking about those, but the question is quite important. The country is paying a lot of money to offload the risk, so we need to explore what the worst-case scenarios are. If it all goes horribly wrong—if you flick the switch and it does not come on, or somewhere else you flick the switch and suddenly discover that it does not work—and you decide that it is too expensive to continue, you can just walk away. We have established that there is no compensation, which means that the UK has to fund alternatives. It has not paid you any money, but we are left with a site that is just a white elephant sitting there. If you walk away, will it be down to the UK to do something with that and clear it? What does it say in the contract? What is to stop you from walking away if it just gets too expensive?

Mr Humphrey Cadoux-Hudson: Too expensive to complete it? What you have spent to date is written off, so the economic imperative on a developer to finish one of these plants is absolutely enormous. It builds up as you go through time. The scenario is unimaginable to me. With this design, there are 277 working PWR reactors. There is no novel technology in the EPR. It is simply an incremental advance on previous generations of technology that have been built by EDF and the Chinese. The Germans were part of the design of EPR in the first place. There is not an example of a PWR that has not completed construction and started work.

Baroness Bowles of Berkhamsted: You are saying that it is too fanciful.

Mr Humphrey Cadoux-Hudson: It is a bit too fanciful. Think about the economic position of having spent £18 billion and needing to spend a bit more to get it working. Of course, a shareholder will spend more at the time. That has been the case for all the other plants that have been built around the world.

Lord Tugendhat: You have made a very impressive case. You are clearly masters of your briefs, the technology and all the rest of it. I

would make only this point. However much confidence you have in what you are saying, and however much confidence you inspire in those who hear it, all of us have seen over our lifetimes that massive projects of this sort overrun far more often than they are delivered on time and that, by definition, the problems that arise are ones that are very difficult to foresee. Therefore, it is not a case of whether we have confidence in your assessments or whether we believe that you have confidence in what you are saying. The point is that, if one looks at the track record of projects of this sort in your industry and others, the record shows that these things usually cost more and take longer than expected. Therefore, any Government that is wise ought to have a plan B in place and an alternative. To say that is not to cast doubt on anything that you are saying. The point is that the Government should look at the record and make sure that they do not have all their eggs in this basket.

Mr Vincent de Rivaz: You are concerned. These two EPRs will be the fifth and the sixth built in the world. I repeat: our confidence is not wishful thinking. It is based on the evidence that we have put in place everything required, with humility—we have our scars from this project, but they have made us stronger—to deliver on time and on budget.

Earlier I talked about the bigger picture. Because there are some risks and some people who are sceptical about our ability to deliver, should we stay idle and do nothing? This country deserves companies like ours. For many years, nobody has done that. Despite all the critics, month after month, in the newspapers, we have been steadily delivering. There was the generic design assessment in 2012, the planning consent in early 2013 and the contract for difference in October 2013. With the British Government, we successfully fought the battle in Brussels. We got the Chinese paying £6 billion.

The Chairman: I think that you have made these points before.

Mr Vincent de Rivaz: I do not want us to leave on a negative note. Last week, we were in London with 400 people: the project team, of course—people from Humphrey's team and from France—and people from local communities. It was touching—moving—to hear from them how this project has already transformed their lives. Take small companies. There was a guy who talked about how his grandfather created his business, which was then passed on to his father and him. He said, "If my grandfather were sitting here today, he would be proud of us for doing this". Colleges and universities are praising what we have done already, because it is changing the skills agenda. The 1,000 apprentices who will benefit from this project will also thank us. The south-west will get a new engine for growth and sustainability from this project. The unions were there, applauding the project. There were all sorts of people, from different backgrounds, united and enthused. Despite everything that they have read in newspapers—all the negativity—they believe that they can deliver it. I have to pay tribute to those people.

Q67 **Lord Lamont of Lerwick:** You are having rather a hard time. You made a strong point when you said that 277 PWRs were in operation and had

been built. I remember that, when people talked about having a great programme of PWRs here, they described it as “taking them off the shelf”. That is a strong point, although it begs the question why the one in Finland and the other one in France do not correspond with this off-the-shelf, Tesco performance.

I want to ask you a question, Mr Spence. Earlier you gave some figures about low-carbon options and compared them with Hinkley. Maybe I have got the wrong end of the stick—maybe I have got tomatoes and pears—but the figures that we have are that it would be £65 to £90 per megawatt hour for a large-scale solar plant, £49 to £90 for onshore wind, £47 to £96 for combined-cycle gas turbines, and £81 to £132 for offshore wind. That puts Hinkley B very much at the top end of the scale, whereas you were implying otherwise. Maybe there is some way in which the figures are different.

Mr Paul Spence: Those figures are taken directly from the Government’s value-for-money analysis. I recognise them. Can I take them one by one? On the solar figure, to have the genuine like-for-like comparison that you would need to have with solar, you should ask yourself the question: what do I do about the fact—

Lord Lamont of Lerwick: Back-up.

Mr Paul Spence: Solar produces four and a half times as much in summer as it does in winter. For example, yesterday we did not get a huge amount of power from our solar panels.

Mr Vincent de Rivaz: That is an understatement. It was below 6 gigawatts.

Mr Paul Spence: There are 10 gigawatts of solar capacity on the UK system at the moment. None of that was producing yesterday evening, when the system was tight. There are 15 gigawatts of wind, onshore and offshore. None of that was producing. Until we find a way of storing—

Lord Lamont of Lerwick: I get the point.

Mr Paul Spence: We have to have the cost of that as part of it, or we have to have something else as back-up.

Lord Lamont of Lerwick: How did you come up with your figures, which put a cost on these external factors?

Mr Paul Spence: I talked about the £10 to £15 of back-up that you should allow when you compare the cost of a Hinkley Point, producing reliable power, with the cost of the intermittent technology. I would add that to your £65 to £90 range, for example. You immediately take it up by £15—probably more, when you realise that we will have to start using sites that are not as efficient for solar power as some of the low-cost numbers. That is the first piece.

The second is to compare it with gas. As I said, there are some scenarios where gas is cheaper. Like all your Lordships, I suspect, in the course of

your long-time observing, I have seen periods in which gas prices were very low and periods in which they went very high. The one advantage that nuclear has is that, once we have built it, the cost of running it is predictable. Therefore, the cost of the electricity is predictable. There is an element of lack of volatility. The Government have seen value in that. In their value-for-money comparison, they have taken that and taken the impact on bills. They have said that Hinkley places an extra cost from some of that insurance on bills, in some circumstances.

The Chairman: I am afraid that I will have to draw this to an end, because we have run out of time. Thank you very much for your helpful and, if I may say, spirited answers.

Examination of witnesses

Mr Peter Atherton and Mr Tom Burke.

The Chairman: Mr Atherton and Mr Burke, thank you very much for joining us. You were present during the last session. As you can imagine, we will want to follow up on some of the points. I will ask Lord Kerr to kick us off.

Q68 **Lord Kerr of Kinlochard:** You have heard a spirited defence of the project from EDF. Do you think that it will provide value for money?

Mr Tom Burke: You certainly could not tell on the basis of the three-page document supplied by the Government. There is simply not enough information accessible in that document to come to a reasoned conclusion about whether it provides value for money. Personally, I do not believe that it will. I believe that there are a number of other ways in which we could go about delivering affordable, low-carbon electricity to Britain's consumers, at lower cost than is proposed in order to support Hinkley.

Mr Peter Atherton: We will not know for about 46 years, because that is when the contract will roll off. A child born today will be enjoying their 46th birthday when we stop paying under the contract for difference. Only then will we really know. However, on the economics that we know today and the way in which the project has developed, I think that it is extremely unlikely. Frankly, the Government have not even attempted to make the case that it will provide value for money, never mind prove that it will.

Lord Kerr of Kinlochard: Both you and Mr Burke have been pretty sceptical in public—indeed, in print. To what extent is your scepticism economists' scepticism, or is it on the technology point that we debated with regard to Flamanville and the Finnish EPR? Do you think that the fact that the technology is unproven means that one should not go ahead?

Mr Tom Burke: The economics of Hinkley do not stack up—full stop. This particular reactor type is unproven. It was interesting to hear Mr de Rivaz say at one point that it represented good value for money as the first of a kind, and then go on to defend the record on the basis that this would be the seventh one to be built. There is an interesting little contradiction there.

This is a much more sophisticated reactor that has had nuclear engineers—in fact, EDF personnel—saying that it is unbuildable because of its complexity. The complexity has been introduced as a way of trying to enhance its safety features. I am not a nuclear engineer, but there is publicly available scepticism among the people who are nuclear engineers about the extent to which this is a buildable reactor.

There have also been reports—again, with what weight I cannot say—that EDF has no intention of building any more of these reactors, given the experience that it has had with the current set. Reference was made to 276 PWRs. That is a bit like talking about 276 birds. Yes, but there are 9,000 species of bird. They are all different. Hardly any have been built in series, so there has been very little learning. You would need to check, but I believe that there has been one reactor that was built and never operated. One of the EDF people said that they had all operated; I do not think that that is completely true. I know that one that has just started operating took 43 years to build.

Lord Kerr of Kinlochard: Where is that?

Mr Tom Burke: It is in the United States. I forget the name of the reactor.

Lord Kerr of Kinlochard: With the Finnish one, one reads that there is a problem with the reactor vessel. It sounds fairly important.

Mr Tom Burke: It is not the Finnish one—it is the French reactor at Flamanville. The ASN—the French nuclear regulator—has discovered what it describes as a very serious problem with the quality of the carbon used in the caps of the reactor vessels. I guess that it is about a year from finally reporting on the implications of that. There has been a whole series of other, recent announcements about difficulties with the forgings in the existing fleets of reactors in France, which speaks to the question of whether EDF will be able to finance its reactors. Its finances are already under some pressure. The reason our electricity prices will go up is that the French regulator has required it to shut down some of its reactors because of those issues. Interestingly, that is leading to a spike in our electricity prices, which Mr de Rivaz also referred to.

Q69 **Lord Layard:** I want to come back to the cost of alternative non-carbon energy. Mr Spence answered that the strike prices of the recent contracts for difference that will be in force at the same time as the one for Hinkley average £120, which seems high. That sounded like a rather convincing answer. It is very different from the ranges of costs offered by the Government, which somebody quoted about five minutes ago. How do

you react to his answer?

Mr Tom Burke: One of the important things to bear in mind as you look at the question of costs and where the value for money is coming from is that the costs of renewables have fallen considerably and dramatically over the last few years, to the point where, by the time Hinkley is up and operating fully, it is likely that they will not require any subsidy at all. Nobody has ever suggested that you could build a nuclear power station and not have to subsidise it. If representatives from DONG Energy, the offshore wind builders, were sitting here, they would say that they could build everything that Hinkley will provide at £70 to £80. The chairman of DONG made that remark about four or five weeks ago.

Without examining the basis on which the Government have produced their figures, it is very difficult to know whether they are reliable. Some of them refer to a period when early contracts for difference for renewables were made that nobody would argue were bad value for money. The one upside is that at least they are 15-year contracts, not 35-year contracts.

As far as I know, they also do not have the “take or pay” provision that the EDF contract has. Mr de Rivaz made a lot of play about taking the construction costs. He is able to do that because he has transferred all the commercial risk to Britain’s consumers. Essentially, he has a guarantee that he will not have to bear the commercial risk. The way renewable electricity is developing in this country, by the time we get to 2030 or so we may well find that, because of the nature of the EDF contract, we are being required not to take cheaper electricity and provide cheaper electricity to Britain’s consumers. It seems to me that it would be extremely difficult for any Minister of the day to justify that position.

Q70 **Lord Burns:** Can we focus the argument and, in a sense, take out some of the issues as to whether it will be built on time? Let us assume that it is built on time and delivered in the way in which they say it will be delivered, and focus on the issue of commercial value and the £92.50. They made a lot of arguments that they can do this, so let us assume for the moment that they can. How do the numbers then stack up in your mind? Where are the convincing arguments about alternatives, particularly taking into account the intermittent supply of many of the low-carbon alternatives that lie behind your point?

Mr Peter Atherton: Can I tackle the overall cost of the project and the timeframe to build it, to put it in context? Flamanville is running four or five years late—

Lord Burns: I am sorry, but I would like to leave aside all the issues about construction risk for the moment. I want to assume that they will deliver this to time. I then want to examine what the economics look like.

Mr Peter Atherton: That is not what I was about to do. I was about to point out that the new timeframe for Flamanville to complete is 10 years of construction, with an £8 billion to £9 billion construction cost. Those

numbers may ring a bell, because that is precisely what EDF says Hinkley will take. In other words, the lesson that EDF learnt from the disasters that it has had at Flamanville and Olkiluoto was to double the construction period and double the budget. Of course it should be able to build it on time and on budget, because it has given itself the mother of all budgets and a 10-year construction programme. If either of those two things was in question even by 1%, it would be unthinkable that you should go ahead with the project.

The strike price is £92.50, but do not forget that that is in 2012 money. If we inflate for CPI—because it is linked to CPI—today it would be about £99. If Hinkley was operating today, it would be getting about £99. If you assume inflation of roughly 2% to 2.5% through to 2025, the opening strike price will be somewhere in the low £120s per megawatt hour. That is the price that it will get when it comes on stream. If you put that in fossil fuel price equivalents, assuming the current carbon price of £20 per tonne, to get to an electricity price of £120 per megawatt hour you need about \$220 to \$240 oil. That would give you a gas price of about \$25 per MMBtu.

One argument that is often put forward by the Government and, obviously, EDF is that we are protecting ourselves against a future world where there are very high electricity prices because we have very high fossil fuel prices. We have never had a world where oil and gas prices have been anything like that in nominal terms—or, indeed, in real terms. Do not forget that long-term shale cost recovery in the States is now about five bucks—and they can ship it to us for another \$1.50. There is 50 years-worth of shale in the States, so the chances of the world gas price being \$25 per MMBtu by the time we get to 2025 are minuscule—not impossible, but minuscule.

Lord Burns: I am confused. I thought that we were going to compare this with low-carbon alternatives, not with shale and oil. The question is: what are the low-carbon alternatives that are convincingly better than this?

Mr Tom Burke: I wrote a letter, which I sent yesterday, with a list on the back of the different kinds of options that are available. One of the problems with looking at this question is that, if you consider it only as a technology choice question, you get very tied up in narrow issues that do not reflect the full value question. Electricity systems everywhere are undergoing a revolution—essentially, because of the digital revolution getting into electricity, plus the technology development of renewables—that sets a much higher value on flexibility than on volume. You have a trade-off. There is nothing in any of the Government's published statements that shows how they have made that trade-off.

If you just look at one piece of technology against another, it is very difficult to get accurate figures because you are comparing the capital flow for something like a nuclear power station, which has a very big front-end load, not much through and then a very big back-end load—if you discount those things, you get a very misleading sense of what the

real costs are—with a technology that has a very short lifetime. It may have a 20-year overall lifetime, and you can build in modular ways. You have a completely different flow of capital through the system. You have to know how the assumptions have been made and to take them apart. People say that they are comparing like with like, but very often they are not. There is a real softness in all those figures. So I would recommend that you are very sceptical about everybody's figures—not just EDF's but those of all the people who are saying what they could do on renewables.

Lord Burns: That is why I asked you for your view on what the low-carbon alternatives are and whether the economics are significantly better than this.

Mr Tom Burke: On energy efficiency, the McKinsey report showed that you could take 23% out of our electricity demand, at much lower cost, by doing things that we know how to do but have not done very well policy-wise. We could build interconnectors at much lower cost to replace most of the electricity that would be supplied by EDF. We could build offshore wind. As I have already mentioned, DONG is now saying that it can bring in offshore wind at somewhere between £70 and £80 per megawatt hour. Others are coming in as well, because of the competition in that industry. You have onshore wind—

Lord Burns: Does that include the intermittency costs?

Mr Tom Burke: No. I made the point to you before that you then have to look at the whole system. I do not have all the numbers in my head, but my organisation has put in quite a lot of work on the value of flexibility, as against big stations. In every circumstance I can think of, investing in flexibility gets you better value for consumers. The work is not published yet, but I would be very happy to share it with the Committee.

Lord Burns: But the one thing that intermittency gives you is a lack of flexibility.

Mr Tom Burke: Yes, so you have to be able to firm that; that is the technical word that people use. When you have taken account of all the intermittency that you have, you still have some load to meet. How can you meet it when you have none of the other things? In our system, the residual on that is about 20 gigawatts an hour. The question that you are asking is: what is the cheapest way—the highest-value way—of firming that piece that you absolutely must have? The figures that we can supply to you—please treat them with suspicion—will demonstrate that renewables will always give you a better increment of value than nuclear.

Lord Turnbull: On the basis that attack is the best form of defence, Tom, I was surprised at your attempts to turn the whole intermittency argument on its head. In the letter that you have sent, you say, "In order to maintain security of supply, a grid containing Hinkley must have 3.2 gigawatts of additional supply instantly available, in case of an unplanned outage. These occur frequently in the current nuclear fleet, largely for

non-nuclear reasons. Supply of renewables is variable, but its variability can be forecast with high confidence, thus permitting a wide range of flexibility measures to be brought into play at lower cost". So what you are telling us is that the intermittency argument lies with the nuclear side.

Yesterday and in the previous five days, not a single gigawatt, virtually, of wind was produced. Today the figure is 2.9—6% of the total. So from day to day, you can get huge variations in wind. You may be able to predict it—the Met Office may tell you that it is coming—but you cannot do anything about it. I find it completely implausible that, by pooling renewables somehow, you can reduce the intermittency problem to below that of something like Hinkley. Peter Atherton may have a view on that.

Mr Peter Atherton: I agree. If we are going to go down the low-carbon route, nuclear power should play a significant part in that. Unfortunately, the three Governments—starting with Labour, then the coalition and now the Conservatives—have managed to design possibly the most expensive programme for delivering nuclear power that we could have come up with. If 10 years ago you had asked me and Nick to sit down and come up with a scenario that would deliver the most expensive set of nuclear power stations in the world, we would have struggled to come up with a process worse—or better, depending on how you look at it—than the one that we have at the moment. My problem with Hinkley is not just with nuclear power. Personally, I agree that nuclear power has a role. My problem is that we are delivering this in a staggeringly expensive way. Frankly, Hinkley is not the worst bit of it. In the UK nuclear programme, Hinkley is now the least of our worries, because it is under construction. What is coming next is more worrying.

Lord Turnbull: Why is it more worrying?

Mr Tom Burke: Lord Turnbull would not forgive me if I do not reply.

The Chairman: Can we have a very short reply and then move on?

Mr Tom Burke: There was no wind and, as Mr de Rivaz said, no solar yesterday. The grid knew that well in advance. At one point yesterday afternoon, it declared that it would have to take up some of the options that it has in order to ensure security of supply. Later that afternoon, it cancelled them. The only thing I disagree with is that there is nothing that you can do about it. There is a lot that you can do about it. There is an enormously sophisticated package of measures available to the grid—and more to come—that allow it to deal with exactly that situation, at lower cost than having a 3.2 gigawatt unit on standby, ready to go. It is about your insurance costs.

Lord Lamont of Lerwick: Mr Burke, you and I first discussed this in 1979, if I remember rightly, when you were very strongly opposed to Sizewell B.

Mr Tom Burke: Indeed.

Q71 Lord Lamont of Lerwick: I got the impression that you became more pro-nuclear, but you seem to have reverted. Of course, Sizewell B was a pressurised water reactor. It was a Westinghouse design, but the nuclear vessel was built by Framatome; it was a French product. Mr Cadoux-Hudson said in evidence that the PWR was very similar to the EPR; the only difference was that the EPR had the word "European" in front of "pressurised water reactor". That cannot make it unworkable or more expensive by itself. He said that the EPR was simply an incremental advance—that it was essentially the same type of reactor of which 277 had already been built and were working. You have chosen to disagree with his view that this is a marginal alteration.

Mr Tom Burke: I disagree with a lot of statements that they made. I disagree on what is an industry standard. There is a reason why people talk about generation I, generation II, generation III and generation III-plus. We are now also talking about generation IV. There are three generations of nuclear reactors that have been built or that people have tried to build. There are significant differences in the engineering between one generation and another. The difference in the engineering in the EPR is driven largely by safety concerns. It has a failsafe mode in it or a piece of failsafe engineering, which is partly what has led to the increase in costs. As I said, I am not a nuclear engineer, so I cannot give you the detail, but it is readily available. It really is misleading to suggest that what you have in an EPR is simply an incremental variation on something we have had a lot of experience with. It is not true to say that.

Lord Darling of Roulanish: I have a quick question for Peter Atherton. You said that, when all is said and done, you had less problem with Hinkley, but you have big problems with what is coming next. What do you mean by that?

Mr Peter Atherton: The plan is that we build somewhere between 14 and 18 gigawatts of nuclear power station capacity to replace existing capacity, and a bit more. That helps us to meet our environmental targets, so it is a crucial part of the build mix.

There is a lesson from history, particularly UK history. Many of you will be familiar with the AGR programme, which was one of the biggest industrial disasters of the 1970s. It was a disaster because we chose a bespoke UK design but did not even stick to that design. We split the work up among a number of consortia, which then built their own designs. If the Government's plan goes through and we build these 18 gigawatts, we will build, virtually simultaneously—because these things will overlap with one another over the next 15 or 20 years—four EPR reactors, two APR-1400 reactors, the Chinese design, which is a bespoke design that has never been built anywhere in the world, and two versions of the Japanese BWR reactor. In other words, we will be building four different reactor types, with at least five different manufacturers, simultaneously. That is industrial insanity. It is the equivalent of building the four new Trident submarines at different shipyards, to different designs. Is anybody suggesting that? No. Why are we going to do it with nuclear power stations? It is insane.

Q72 **Lord Sharkey:** Is it really necessary for the UK to build nuclear reactors at all? As a subset of that question, what do you think of the prospects for a small modular reactor?

Mr Peter Atherton: I have met a lot of companies involved in the small modular reactor. They are working on some very interesting techniques, but it all seems very expensive. I come away from every meeting thinking they do not seem very cheap—and it is 15 to 20 years away.

Do you need a nuclear programme? I disagree with Tom on this. If you are going to hit the absolute target of reducing CO₂ emissions from all the carbon-intensive electricity in the timeframes we have agreed to, it is very hard to see a pathway without a substantial nuclear programme. That is why the Government have gone forward with it.

Mr Tom Burke: On SMRs—small modular reactors—the thing you have to think about is how many orders you need before you build a factory to produce them and who is going to make those orders. As Peter says, there is a lot of interesting technical development going on, but it is extremely difficult to see where the market goes to create the advantage of modularity.

Mr Peter Atherton: One of the reasons why they seem to be cheap is that the idea is that you would site them in the middle of cities. That is a challenge to our planning system, I would have thought.

Mr Tom Burke: To answer your question about whether we need nuclear, I am sceptical. Peter is more confident than I am. I am more open-minded on the idea than you might think, but it is certainly not a 16-gigawatt programme. The note that I sent said that you need to have about 30 gigawatts. In the worst case imaginable, when everything else was somehow off—not just the renewables, but your storage and your electric vehicles—you would need to be able to supply that. If you could not think of other things to do to help you firm up your supply, you would need to build some nuclear reactors. However, you would need to build perhaps 9 gigawatts, at most. It would be nowhere near the 16 to 18 gigawatts people are talking about.

Q73 **Lord Tugendhat:** We have probably exhausted the question of contracts. Can I jump to a different question? Do you think that there will come a point at which the wholesale price disappears and the cost of electricity generation becomes fixed? What do you think the implications of that might be?

Mr Tom Burke: The way I understand development in electricity systems globally, taking advantage of technology, sophisticated software and our data-handling capacity, is that we will move over time to a price for service, rather than a price for electrons. We will move to a very different business model from the one that we have now. It will be much more like telecoms, where you pay for access to the service, perhaps in different packages, rather than a commodity business, which is what electricity currently is. That is the logic of the kinds of developments that we are seeing in technology.

It is contingent on designing your market—your regulatory systems and the way you set up your market—in order to do that. That is why I make the point that the real issue here is not a technology choice issue, where you end up in quite marginal discussions, but what your system architecture is for the 21st century. It is my feeling very strongly that neither this Government nor their predecessors have taken that question very seriously. They have not thought very seriously about a different system architecture and are largely making a very big bet that the system architecture in 2050 will be pretty much what it is now. That is a very risky bet.

Mr Peter Atherton: The importance of the wholesale price now in setting the end-user price and the remuneration to power generators is declining every year, because more of the system is being locked up under government contracts. Germany is a few years ahead of us on this. In Germany at the moment, you have some of the lowest wholesale prices in the world—and the lowest in Europe—but the highest end-user price. The revenue for those people who are under government contract—renewables, in particular—is protected, so they do not give a damn what the wholesale price is. Only those generators who are exposed to the wholesale price care, but that is a shrinking number.

Carrington, a power station currently under construction—it is being commissioned as we speak—which received financial close in 2012 and is being built by the Irish company ESB, is the last power station in the UK, of any type or size, that was approved by a board of directors based on its commercial terms, without a contract underpinning 100% of the economics from the Government. It was approved in 2012. There has not been a single megawatt approved since. Under the current system, there will not be a single megawatt. Nobody will build a single megawatt of anything unless they have a government contract that says, "You will be rewarded in your entirety"—in other words, 100% of the economics is covered by the government contract. That is the system we have found ourselves in. I am not sure that the Government particularly expected to find themselves in this situation, but it is the situation we are now in.

Q74 **Lord Forsyth of Drumlean:** I thought that we had privatised these things. It has been a bit of a depressing afternoon. Can you cheer us up by indicating what two or three things the Government might do to correct current policy failures?

Mr Tom Burke: They could take the system architecture question seriously and think it through. Part of that would almost certainly involve creating a system where you had an independent system operator, not the system that you have now. That would take you a long way, because what you would have to do around it to make it work would address quite a lot of the problems Peter was talking about.

Mr Peter Atherton: If you look at the timeframe from 2003, when we signed up to the European directive on greenhouse gas reductions, and the whole process with the approval of the renewable energy directive, our various White Papers and the EMR programme, you find that a lot of

our really poor policy decisions have been driven by the fact that we set very hard timetables in law—that we have to hit certain targets by 2020, 2030 and, subsequently, 2050. Hinkley is a classic example of that. We ended up with the project that we have today at Hinkley because of the Government's desire to deliver against the 2030 targets. It has led to some horrible policy decisions.

I would not question at a personal or a professional level our pathway to a low-carbon future, but I would relieve us of these very hard, in-law target dates, which are utterly counterproductive and have led to some horrible policy decisions, and have something much more flexible. I might keep 2050, but I would have a much more flexible pathway for how we get there, without these intermediate, hard set targets, which have been very counterproductive.

The Chairman: I have a follow-up on that. If there is some flaw within Hinkley C—that must be a possibility—and there is a delay, clearly there will be a gap. You mentioned plan B. What should the Government do to put plan B in place, so that the lights do not go out in 2025?

Mr Tom Burke: If you remember, Hinkley was first proposed as a solution to the supposed generation gap that there was going to be at the end of this decade and the beginning of the next. That was when we were promised that it would be cooking our turkeys by 2017. The gap did not emerge. We did not freeze in the dark.

If the Government were to go ahead and fail, I do not think that it would mean that we would end up freezing in the dark. There are lots of things—we have talked about some of them—that you could move in to address that piece. There is some scope to extend the life of the AGRs. A lot of the assumptions about what you need Hinkley for have been based on assumptions about when the AGRs come offline. One of the most significant things in encouraging EDF to keep the AGRs online was the carbon price, because it helped to give it a competitive advantage in the market and to make the necessary investments to keep those going. So there is more flexibility than we are often led to believe. The question is whether we now value that as an asset for the system or whether we go on valuing more.

Mr Peter Atherton: There is no issue around security of supply. It is a 10-year construction programme. If it falls over in year 5, for example, you still have five years to replace it. It takes two years to build a gas-fired power station, if we want to go down the gas route. It takes two and a half years to build an offshore wind farm, once you have decided to do it. From a security of supply perspective, there is no issue. However, if the nuclear programme as a whole drifts into the 2030s, it will be very hard to hit the 2030 environmental targets.

The Chairman: Lord Kerr, do you want to come in? Is it a quick comment?

Lord Kerr of Kinlochard: I am surprised that your answers to Lord

Forsyth's question about three things that the Government could do did not include, "Get off the grass. Recreate a market. Go back to where we were, or thought we were, 20 or 25 years ago". Is that completely hopeless?

Mr Peter Atherton: It is very difficult. At the end of the day, if you are going to decarbonise, you are requiring an industry to do things that are fundamentally not economic. The short plans were very cash-generative and nice plans. You do not want them any more, because they are CO₂ polluting. You want the industry to build things that are fundamentally not economic—and very unlikely to be economic, certainly vis-à-vis fossil fuels, for the foreseeable future. To have a market where normal commercial decisions are made by boards of directors in that situation is very tough. That is why, from about 2010 onwards, the Government effectively renationalised the investment-making process in the industry. Now, as I point out, a group of civil servants literally sits in DECC, or whatever it is called these days, and decides what gets built, where, when and using what technology, and how much will be paid for it. That is the reality of the situation that we have.

Lord Kerr of Kinlochard: If you look at America, they will achieve their targets, but they are going about it in a completely different way.

Mr Peter Atherton: Actually, power generation in the States is largely regulated, in most states. It is deregulated in only a few states.

Mr Tom Burke: And it is the subject of a quite intense debate that is going on currently. If you wanted to reduce the pressure on the civil servants whom we have recreated as a virtual CEGB, you need to invest much more aggressively in energy efficiency and in reducing demand. We have not put the policy effort into gaining the benefits there, which flow straight into people's pockets.

The Chairman: Thank you very much.

Examination of witnesses

Mr Tom Samson and Mr David Stearns.

The Chairman: Mr Stearns and Mr Samson, thank you very much for joining us. You sat in on the previous sessions so you have the drift of what we are talking about, but it will be very interesting to hear from you. Can I go to Lord Layard for the first question?

Q75 **Lord Layard:** We would very much like to hear from each of you about the new nuclear projects that you are involved in. When do you think you will be taking the decisions and when do you think they will come on stream?

Mr David Stearns: Good afternoon. Thank you very much, Mr Chairman. I wonder if I might be able to make a preliminary statement with respect to introducing myself.

The Chairman: Can you keep it short because we have all your biographical details?

Mr David Stearns: I will keep it very short. That is absolutely fine. My name is David Stearns. I am the business development director for Horizon Nuclear Power. We are developing a Japanese ABWR and bringing it into the UK on the Isle of Anglesey. We have two sites, the second one being at Oldbury. With respect to my job as business development director, I am here to ensure the investability, the bankability and the affordability of our project and our programme.

With respect to our programme, Hitachi, as the sole shareholder and sponsor, purchased both sites and began implementing the technology assessment and safety case in 2012. The design process acceptability has been under way now for four years and we are in the final phase of that acceptance process with ONR. Our level zero dates consist of 2017 with a finalisation of that GDA process. In 2018, we expect to have completed the commercial and financial case for the project, allowing us to take the project investment decision in mid-2018. In 2019, we expect to take the financial close decision—the FID—and we expect to be on line in the early part of the 2020s, perhaps by 2025. Thank you.

Mr Tom Samson: For NuGen, we are implementing three AP1000 Westinghouse reactors in Cumbria, next to the Sellafield site. We are approaching the end of our GDA process with the ONR, which should be completed by Q1 2017. In a similar timeframe, we are also planning to submit our DCO application to the Secretary of State in the first half of 2017 and submit our nuclear site licence application to the regulator—ONR—to demonstrate NuGen’s capabilities to be a site licence holder in the UK.

We are actively engaged right now in finding solutions to our financing challenge and we are expecting to achieve our FID or our financial close by the end of 2018. Hopefully, by mid-2017 we will have validated what that funding structure looks like, particularly the conditions that will allow us to bring in debt and other sources of equity to ensure the funding of the project at the end of 2018.

The Chairman: Could you give us an idea of the total cost of your respective projects and the sort of contract-for-difference price that you would have to achieve to get the rate of return that you are seeking?

Mr Tom Samson: We are still in the development and engineering phases. We are hoping to have EPC estimates for the complete project in the early part of next year. So any numbers we have today would be premature to share in specific terms, but they are in the rough range of £13 billion to £15 billion for the cost of the project. Our aspiration and goal is to deliver a strike price that is less than Hinkley. That is certainly

our aspiration and our goal as a company, as NuGen, to deliver low-cost, affordable and reliable nuclear power to the grid.

Lord Turnbull: Is it a smaller site?

Mr Tom Samson: No, it is larger. It is 3,800 megawatts gross. It is three units. It is roughly about 3,400 megawatts net on to the grid.

The Chairman: Mr Stearns, can you add anything?

Mr David Stearns: Similar to NuGen, Horizon is going through the costings process. Hitachi has spent north of £1.5 billion on the development, engineering and the preliminary site works to ascertain what those costings are most likely to be on a full, built-out basis for commercial operations by 2025. We, like NuGen, do not have firm costings. We do not have a firm price at this point. We have four operating ABWRs that have been built on time and to budget in Japan. One of those plants, KK-6, is our reference plant. At this point we do not have a number. We believe it will be certainly less than Hinkley, and I say that as well from a strike price perspective.

Lord Turnbull: The argument we were having earlier was that we would initially try to follow the French initial policy of building tens of reactors to a similar design and get continuous improvements. You heard the criticisms of having three, four or five different contractors building different models. Do you share that criticism, or do you think, nevertheless, that because you are, maybe, the only one in Britain of that kind—you are not the only one in the world—you will still get the benefits of being part of a wider family? Which is it?

Mr Tom Samson: Clearly, there are benefits in having diversity of technology in a marketplace. If you look at some of the largest nuclear markets in the world, such as the US or Canada, they have quite a diverse fleet. We think that the track record of delivering each technology is clearly the important element here. We are going to be the nth of a kind—the 17th, 18th and 19th AP1000 unit in the fleet. There are currently eight under construction, and there will be eight more under construction before we begin in Moorside. The delivery certainty and the confidence comes from taking the lessons learned from that global experience and building it into a UK mindset for delivery in this country.

So there is some benefit in having a diversity of technologies. There are many technologies that have been delivered successfully. We tend to focus heavily on the EPR challenges in Olkiluoto and Flamanville, but there are many other technologies that have been delivered on time and on budget. David has mentioned Japan. Korea and the UAE are examples of successful delivery; they are not necessarily technology dependent but they are delivery dependent.

Mr David Stearns: I absolutely agree with Tom's comments. From the perspective of our project, Hitachi has been involved in 20 new-build projects beyond the four that are operating in Japan. An additional two

are in construction in Japan as well as in Taiwan. Hitachi has been involved in 20 different new-build projects. The leaders of our supply chain—the three companies that are leading our construction programme—have been involved in upwards of 170 to 180 new-build projects.

Q76 Lord Darling of Roulanish: You will be aware that there are many people who think, at the present time, that it might be cheaper for the Government to say, "Instead of going through this elaborate quasi-market process, we will just build nuclear power stations because they are so expensive, rather than getting the private sector to do it". What do you say to that?

Mr Tom Samson: I would suggest that the private sector and the players who are actively pursuing these opportunities in the UK are here because they have a track record and an experience that is of benefit to the UK from delivering projects successfully overseas during the past two or three decades while there has been a hiatus of delivering projects in the UK. I certainly think that the UK is a strategic stakeholder in that process and needs to be sure of the delivery credentials of the technologies and the companies implementing them. But it is important to benefit from that global expertise in ensuring that we can deliver the projects here in the UK. Certainly, the Government have a role to play in that, but a nationalisation strategy would be a rather extreme solution to a challenge of delivery and capability that relies on an international marketplace.

Lord Darling of Roulanish: But people would also say that, if the policy that you advocate locks us into paying an extraordinarily high strike price because it costs you far more to borrow than it costs the UK Government, it might be sensible for us to look again at this whole business.

Mr Tom Samson: Looking at the elements of the infrastructure that need to be implemented and how it can be, potentially, carved up in a different way to allow the Government to take a different role in some of the enabling infrastructure, might be a valid perspective.

Lord Darling of Roulanish: You mean the grid or something like that.

Mr Tom Samson: The National Grid already funds that through its process, but, potentially, some of the common works, such as the seawater intake and the civil works. Again, it is a departure from an existing and proven model to put the risk into the companies that are going to be required to deliver that project.

Lord Darling of Roulanish: Are you, as a company, still going to be around in 60 years' time when the decommissioning costs start?

Mr Tom Samson: I certainly hope so. We are certainly factoring in the funding of the decommissioning plan in the associated economics to ensure that the decommissioning burden is fully reflected in the strike price.

Lord Darling of Roulanish: Would you be looking for a similar deal to EDF's in relation to the Government guaranteeing bonds that you might issue to fund this?

Mr Tom Samson: For us, the financing challenge is quite unique. We need to build on the technology, experience and delivery capability of our consortium with Westinghouse and Toshiba and look at ways, if possible, of attracting debt, and share that funding burden with sources of capital that might be willing to provide loans or investments against a technology of this nature. Certainly, with export credit agencies, that is something that is a viable path to pursue and something that we are actively pursuing.

Lord Darling of Roulanish: You would be looking for some state somewhere to be funding some of it.

Mr Tom Samson: In the form of debt, through an export credit agency arrangement or some other form of support.

Lord Darling of Roulanish: Do you want to comment on any of these points, Mr Stearns?

Mr David Stearns: There is quite a lot there. Going back to the nationalisation point, I agree that that seems like a fairly radical and revolutionary approach to solving a problem that is—I do not want to call it “mundane”—more practical than anything else. This Government and successive Governments for the past 10 or 15 years in this country have worked hard and quite consistently in delivering a framework for low-carbon generation. Nuclear is part of that, and Hinkley is, maybe, the first beneficiary as an investor, as well as the end users.

All my adult life I have been financing all sorts of energy projects, including nuclear, around the world. I do not necessarily see the role of government, naturally, as being that of a developer: for example, that of doing the hard work, the daily heavy lifting, of choosing a technology, of driving a process through a regulatory acceptance procedure and raising all the financing—and for the public sector to be taking all the risk. I do not necessarily think that that is what is required at this point. There are multiple nuclear delivery models around the world in which the public sector has taken all the risk and will continue to do so. That is not the only approach. The model that we have here in the UK is quite advanced and leaves quite a material amount of risk with the private sector and the investor: the development process, the construction risk and availability.

Lord Darling of Roulanish: Ultimately, with a nuclear project, the risk comes back to the Government. If anything were to happen to your companies, we are stuck with a very expensive power station that has all sorts of problems in relation to containment of material. That risk is always going to come back to the Government, one way or another, is it not?

Mr Tom Samson: The Government are an essential stakeholder in any nuclear project in this country, and certainly that is the case in the UK.

Mr David Stearns: But there are safeguards.[Click here to enter text.](#)¹

Q77 **Lord Sharkey:** In relation to the sources of funding, of the reactors that you have built so far, what percentage has been private and what has been public?

Mr Tom Samson: In terms of the eight units that are under construction in the AP1000 fleet, four are in China and four are in the US. The US projects are funded by the customer in a regulated asset base; the customers are paying for those projects during the construction phase. In China, I believe that the projects are funded by the Chinese Government.

Lord Sharkey: Mr Stearns, the question is: of the reactors that you have built so far, what percentage of the finance involved has been private and what percentage has been public?

Mr David Stearns: The four operating reactors in Japan were financed in a regulated environment, through the rate base. It is very similar to the US model—the south and the south-eastern US model—but on the balance sheet of investor-owned utilities such as TEPCO or Chubu.

Q78 **Baroness Bowles of Berkhamsted:** What do you think of the deal that the Government have obtained on Hinkley? Do you think the controversy that surrounds that is going to make it more difficult for you to get a deal with the Government or is it going to make it more difficult perhaps to get investors involved?

Mr David Stearns: Let me give Tom a break and maybe I will take that first. It seems to me, as an outsider, that Hinkley and all the controversy around Hinkley has simply been a victim of its own specificities. The time it took to get to FID, the amount of controversy around the nature of the financing, the nature of the shareholders and the amount of government support that will ultimately be taken are absolutely unique to Hinkley.

We do not consider ourselves comparable at all with Hinkley, simply because this is a technology that we have built before, and that our shareholder has driven and delivered. It is a technology that has been licensed in three different countries. It is very difficult for us to compare ourselves to Hinkley, but we do appreciate that it is a very important benchmark in the public eye: that £92.50 per megawatt hour is a very material price tag for that unit once it gets switched on. So, unavoidably, we will be compared and we are prepared to be compared, but we believe that we have a fundamentally more competitive supply chain and ability to deliver. Ultimately, that will reflect in our risk allocation, in the financing that we have, in the amount of financing that we will need to raise and, we believe, in the strike price.

¹ Note by witness: the ONR's license conditions require adequate resources, including financing, to assure the safety of the public and the environment. In addition, the FAP is designed to assure the taxpayer's risk is remote

Mr Tom Samson: It is a good question. Fundamentally, the CFD is a solution to a market challenge. It is one of the few solutions that is actually working across Europe. We are one of the few countries that are building nuclear right now for that reason, because there is a solution to that market uncertainty. There is also an element that the true cost of carbon emissions is not reflected by the market and is not reflected in these economic comparisons with nuclear and renewable. That is, right now, an intangible in terms of what the consequences are of not delivering another generation of nuclear for the UK. We have benefited from 60 years of nuclear and we should, as a country, benefit from another 60 years of nuclear from both the stability perspective and the emissions perspective.

The other part of the strike price analysis that gets lost is the GDP impacts: the jobs; the scale of the effort to build a project of this size; the 60-year nature of its life; the significant amount of money that is spent every year to operate and maintain it within those communities, providing hundreds and hundreds of jobs over that life cycle, as well as the supply chain opportunities and the industrial development potential that can be realised through a concerted effort to regenerate the nuclear industry in the UK. All those elements need to go into that analysis on top of the things we have already heard about, such as comparing an intermittent supply with a nuclear baseload 24/7 source of power for 60 years. That fossil volatility and that capacity when it is not available is also dwarfed by the GDP, jobs and the carbon impacts.

Q79 **Lord Kerr of Kinlochard:** You heard Mr Atherton being a little dismissive of the possibility of small modular nuclear reactors rather than big whoppers of the kind that arise in what NuGen is proposing to build. It is a silly question, really, but do you agree with Mr Atherton? Do your companies build any small ones? Do you think they could be made cheaper than they now are?

Mr David Stearns: I had the opportunity to sit in on the previous session. I agreed with very little of what Peter Atherton said, quite frankly. The low-carbon energy options and the affordability of them is a very serious question for this Committee and for all of us. We do not take an exclusive approach to this. We do not believe that there is only one solution. We heard from the EDF representatives as well that storage has to be part of that, with offshore and onshore wind and solar. There are many different energy options. I did not hear about demand-side management. I would expect people to talk about that as well if they were sitting on this side. That is not something that an investor or a sponsor would normally talk about, because that is negawatts, and we sell megawatts. But we have to make all of that part of the discussion. I think SMRs are absolutely part of the paper-based solution. Is it 20 years away or 50 years away? I really do not know. But it has to be part of the methodology—absolutely.

Lord Kerr of Kinlochard: Are you making any yourself?

Mr David Stearns: No.

Mr Tom Samson: NuGen is owned 60% by Toshiba, which owns Westinghouse. It acquired Westinghouse from BNFL eight or so years ago, but Westinghouse has an SMR technology and is looking to contribute that into the Government's current process. I agree with David that we need an energy mix that reflects a variety of technologies and a variety of solutions for a variety of reasons—stability, security of supply and climate being three.

The potential for SMR is one of industrial capability within the UK. That is a greater opportunity for something that is new to become part of the UK industrial landscape. The challenge in developing nuclear projects, which will be equally faced by SMR projects, is that the amount of investment that even companies like Horizon and NuGen have made to get this far in a complex regulated market to create capabilities, to have the right and the ability to operate and manage a nuclear asset, is significant. You have to find a way to ensure that that can be integrated into existing facilities and existing businesses to avoid the burden of that SMR ownership resting on a small asset, because to carry that cost for a small, single, deployable distributable asset would be quite a difficult thing to do.

Q80 Lord Kerr of Kinlochard: Can I ask two more quick questions? One is on the financing challenges that you both say you face and you expect to overcome quite quickly. You mentioned the possibility of debt. Will they involve any state partner, as is the case at Hinkley Point?

Mr Tom Samson: Right now, NuGen's ownership is two private-based companies, and we expect there to be more private-based equity involved. I would hate to rule out any solution today as we try to fund this significant funding gap that we have to be able to build this project. I would not rule out any source of capital, investment, debt or loan to a project at this stage. Certainly, we are private company led. We are private company driven. I imagine that that will continue to be the case even if there are other elements coming to the table and funding the project going forward.

Mr David Stearns: Going back to my previous point, I do not see that government necessarily has a role to finance nuclear, certainly on a post-completion basis. Very similar to almost any nuclear new-build project, however, in competitive energy markets and competitive financial markets, we are faced with a funding gap. We are looking under all the different rocks. We are looking everywhere to see where that funding might come from, be it equity or debt. We would not preclude or exclude anybody at this point in time. But we are solving, ultimately, what is and what should be a private sector asset. There is no reason long term for an operating nuclear power plant to be necessarily in the hands of a Government. It could be. It could also be in the hands of an end user, which ultimately, contractually, it is in Finland, for example, where we have seen competitive financial markets and competitive energy markets, and ultimately very low costs for those end users.

There are different models. We are not at all prescribing that HMG, the Government, must and should take an equity stake or provide direct financing. We are facing a funding gap.

Lord Kerr of Kinlochard: Or by foreign Governments.

Mr David Stearns: Or foreign Governments.

- Q81 **Lord Kerr of Kinlochard:** This is my last question. You both talk about moving very fast once the financing is available. You talk about moving rather faster than EDF talk. I suppose that is because you are both planning to use technologies that you already have in use elsewhere. Could you be underestimating the length of the planning process in this country? We seem to take half a century to decide where to put a runway. You are planning to have your projects on existing nuclear plant sites. Does that simplify the planning process? Why are you confident that you can crack ahead quickly?

Mr Tom Samson: Our site is a greenfield site. It is greenfield next to Sellafield. I think we are the only new build that is not on an existing nuclear site facility. We are in a community that is extremely familiar with and welcoming of nuclear technology being adjacent to Sellafield. We have completed now the second stage of our public consultation process and we are benefiting from the Government's DCO planning regime to enable us to go through a structured process with consultation across the communities and the Secretary of State review period to issue us a DCO permit, along with the Environment Agency at the end of that process. We are in the middle of that process right now. We are confident that that process works. It has worked on other projects. There is the wrinkle of state aid review in the midst of a Brexit situation, but we are still expecting that to happen and have an allowance for that within our schedule.

You are right that we are a development company. It is really important to recognise that, in this development phase, where there are challenges that may arise and issues that may have to be confronted, as I mentioned before, we will be trying to ensure a strike price that is significantly lower than Hinkley's. If I have to change the date by a number of months to get a lower price, I would be silly not to do that. We have to take development thinking to this period in order to ensure that we have a successful project on the table.

- Q82 **Lord Burns:** The Chairman mentioned the challenge of whether you could match the Hinkley price. You both said you either could or you expected to be able to beat it, but it did not sound to me as if it was going to be by some enormous proportion. I would, therefore, be quite interested in hearing you make the case as to why nuclear should have a significant component in the energy mix going forward at those prices by comparison with the prices of other forms of electricity generation.

Mr Tom Samson: The arguments in terms of how you compare apples with apples, with wind or a solar or a nuclear project, need to be stacked up. We heard some of that earlier today and I do not think that Peter or

Tom previously would disagree with that need for a balanced analysis. For me, that equation needs to include the additional capacity to deal with the 60%, 70% or 75% when the wind, solar or renewable power is not available, plus the fuel volatility to deal with that, plus the fact that the asset is not a 60-year asset; it is only a 20 or 25-year asset. Our assets are built for 60 years and there is a high capital cost up front as a result of that.

The other piece that perhaps has not been mentioned strongly enough so far is the carbon pricing element and the fact that, today, the market price for carbon does not truly reflect the consequences of carbon emissions. So the Government have to decide whether they want to commit to making an impact on carbon emissions, and, if so, how they value the benefit from doing so. That is the tough part and that is the part that, strategically, gets reflected in energy policy when you make a commitment to build nuclear because that has a meaningful impact on carbon reduction. Ten per cent of the world's power comes from nuclear, but 40% of the world's carbon abatement comes from that 10% of nuclear. So, it is a meaningful way to make a difference to climate change, and how the Government value that component is a subjective discussion.

Certainly, renewables are a part of that, and I think it is folly for me as a nuclear proponent to argue against new renewable. We do not argue against it. We want to be part of the mix that benefits from renewable because, when it runs, it is not consuming fuel and it provides power—so it is a valuable source. It is wrong to try to compare the two, because they provide different things to the energy mix for different reasons.

Lord Burns: Is it not inevitable, though, that to some degree people are bound to compare them? One has to get into the question of what the balance can be, but it seems to me there is no escape: when one comes to make the case, this question of relative prices is going to be raised.

Mr Tom Samson: If you stack up the equations with the intermittency premium, with additional capacity and a fuel volatility that lasts for 60 years, you may have a different number.

Mr David Stearns: There are a lot of things that the market simply does not take into account—that the market is not pricing. There is the economics of energy, and we have seen that the day-ahead energy market today is quite depressed. Is that a reflection of the tightness of supply that we read about in the newspapers every day? Somehow there seems to be a disconnect.

We might say that there is the economics of energy and then there is the sociology of energy. What do we feel about security of supply? How do we price that? How do we price a negawatt? How do we price a tonne of carbon or a tonne of carbon avoidance? None of that is being properly factored in to the wholesale market prices. Those signals simply do not exist and, where they do exist, they are not effective. I agreed with Peter Atherton—this is one of the facts that we heard—that there has been very

little, if any, non-subsidised investment in generation since 2012. I think that is a fact.

Lord Burns: My second question, following up from an earlier question, is: what are the changes in government policy towards electricity generation that could begin to give us a system that priced these things effectively and led to the right answers for the energy mix?

Mr Tom Samson: Again, I am not a politician, but it is clear to me from today's energy policy that we are taking action. If you look back over 30 years, some of the challenges that we face today are because we did not take action early enough 20 or 30 years ago. The fact that we have a policy framework where actions are being taken and things are being done and facilitated sits uncomfortably with a privatised market where government intervention is needed to stimulate activity—but those activities are tied to long-term strategic benefits to the UK that only the Government can take advantage of.

Lord Burns: Do we have a framework that allows the things that you have mentioned to be taken into account and to be properly priced?

Mr David Stearns: I think the framework is stable. It has been tested; it has been proven in the case of your previous witnesses here. Does it work for everybody? No. Will it work for Horizon? Not per se; not exactly as it is. But we do not think this is a case or a situation whereby we need to be ripping up rulebooks and policies. There is a broad recognition as to what are the risks that nuclear investors can and should, indeed, be taking. How much of that risk can be passed to end users and shared with broader society? We think that each of the technologies and projects, however, in nuclear in particular, is quite unique. A 10-year development and construction period is proof of the pudding. These are not wind farms that you can site and develop, and complete, in 18 months.

Q83 **Lord Sharkey:** Talking about technology, could you explain briefly, in terms adapted to our ability to understand, the differences in the technology between your projects and Hinkley? Do you think your technologies could have offered a better solution than the one proposed by EDF? I suppose the short answer might be that yours works and theirs has not yet.

Mr David Stearns: Can I keep my comment to that?

Lord Burns: He has asked the question that I was going to ask.

Mr David Stearns: I would say that; I would add that, behind those four operating reactors and behind the eight that have been built, there is a BWR owners group. There are 50 or 60 years of industry knowledge and experience. We are Horizon; we are just a development company. Hitachi is a technology provider. We are reaching out and using the skills, resources and assets, across the whole BWR group, the whole nuclear industry, to bring best available practices, the most safe techniques and the operating regimes that are needed, for the ONR, in order to assure

licensing not just to build the plant but to operate it safely for 60 years or possibly more. There is a wealth of assets that are available.

Lord Forsyth of Drumlean: You are not answering his question, which was a technical question—

Mr David Stearns: How are we different?

Lord Forsyth of Drumlean: Yes.

Mr David Stearns: I will not go into the engineering or technical points. I meant that, from a benchmarking perspective, these are very well-known technologies and assets and, in a sense, I would like to say that what you see is what you get—but we have not shown you anything yet in terms of costings and operating regime.

Mr Tom Samson: NuGen's technology is AP1000 PWR. It is an advanced PWR. It is a gen III-plus design with a passive safety system, but at the core of that is Westinghouse technology. We heard from EDF that about half of the reactors in the world today are based on PWR technology; that technology was developed and pioneered by Westinghouse. Its legacy and heritage in this industry is unmatched and its experience in delivering projects globally is also testimony to its capability to deliver at Moorside. So that is PWR technology, with a passive safety system, which provides automatic passive cooling in the event of loss of offsite power for up to 72 hours—but at the core of the reactor is a pressurised water reactor based on Westinghouse technology. The AP1000 is an evolution of the AP600, of which there are many in operation globally, and that PWR technology is at the core of Westinghouse's heritage.

In addition to that, Toshiba, which is our shareholder and has a rich legacy of technology and delivery in Japan, also has an ABWR technology, which is an advanced boiling water reactor technology. They have delivered the AP1000 for this project because that has a UK heritage and it is seen as the right technology for this market.

Q84 **Lord Tugendhat:** I have a quite different question. On the basis of your knowledge, can you tell me how many other western countries you think would welcome the Chinese into their nuclear programme in the way that we have?

Mr David Stearns: That is a very interesting question; thank you. I would say, first, that I do not think nuclear is necessarily the right energy low-carbon affordable solution for every country around the world. I am not sure that that question applies to all the western countries or all the countries around the world.

In terms of openness and the perceived openness in the UK that we have seen with respect to CGN's one-third participation in Hinkley, I do not have specific details with respect to whether there is a political arrangement around that. I just do not know myself. I am aware of the statement that came from the Secretary of State with respect to the

special share and with a set of national security rights that might be attached to that special share for Her Majesty's Government.

The answer that I would give you with that context is that we think this is mostly about safety. The nuclear industry stands or falls—it succeeds or fails—based on safety and its safety and operating record. The ONR is broadly internationally recognised to have the safest, most transparent and highest standard with respect to safety.

My own feeling on behalf of Horizon is that, if a foreign Government such as the Chinese were to participate in any kind of nuclear development or nuclear power plant in the UK, the first port of call should be the ONR. Does that challenge the safety case? Does that leave any foibles? Does that create any weaknesses in the safety case? Beyond that, it is just a political question, and I would leave that to the Government.

Lord Tugendhat: I agree it is a political question. On the basis of your knowledge, I wondered if either of you could think of any other western country that has welcomed or would welcome the Chinese in the way that we have done.

Mr Tom Samson: I would add another dimension to this. The nuclear industry is a very transparent and collegiate industry. We want to support the development and deployment of this technology globally because it is better for us all if we are all operating at a higher level and raising the bar and the standards globally for this industry. China is definitely a part of this industry and is heavily committed to nuclear going forward.

On that basis, it would be essential for us to try to collaborate and co-operate with all global players who are trying to deploy nuclear technology to ensure that we can help support their efforts and provide them with whatever experiences we can in being exposed to this tough regulatory environment and high safety standards in the UK, because that is an unmoveable object in relation to how the UK operates. There are certainly large appetites for investment and there are obviously large appetites for technology deployment that need to be considered in the context of security, which is what the Government have done with the golden share. That security question is not one that we could answer as developers, but there is definitely a benefit in collaboration and global co-operation across the industry, including China, that is beneficial to everybody.

Lord Tugendhat: I am not asking you to answer security questions; I am not asking you to answer political questions. All I am asking you is a very simple question: can you think of any other countries that have welcomed the Chinese in the way that we have or that you think would have? If the answer is no, it is no; if it is yes, you can tell me who they are.

Mr Tom Samson: I think the answer is no, but why should they not?

Lord Tugendhat: Would you say it is no, too?

Mr David Stearns: I am not aware of any specific examples.

Lord Tugendhat: That is all I wanted to know.

Q85 **Lord Forsyth of Drumlean:** I rather rudely interrupted you when you were asked about the difference between your technology and Hinkley Point. We have had two and a quarter hours this afternoon. Listening to EDF, it kept saying, "We are based on PWR". You are saying that PWR is basically what was invented by Westinghouse and that your system works and their system does not appear to work, but we are absolutely assured that it will work. What is the difference between the two systems that makes for this difference? I do not have that clear in my mind. I notice that you, Mr Samson, at the time of the Hinkley deal, welcomed this as a nuclear new-build renaissance in the UK. If it is a new renaissance, I am a bit puzzled, because renaissances do not tend to happen with technologies that do not work.

Mr Tom Samson: I think the renaissance part is the fact that the industry is moving forward and the EPR is now being built at Hinkley. The technology at the centre of the reactor within Hinkley is a pressurised water reactor. It is a technology that creates heat within a pressurised water environment, and that nuclear technology is at the core of that design. It is a similar technology to PWR.

Lord Forsyth of Drumlean: So there is no problem with that.

Mr Tom Samson: I do not believe so. I think the French and the Germans who designed the EPR both had track records.

Lord Forsyth of Drumlean: So where is the problem between the two?

Mr Tom Samson: Again, I am not an expert on the challenges that have faced Hinkley or, indeed, Olkiluoto and Flamanville. Before joining NuGen I spent five years in Abu Dhabi in its nuclear programme, which was again deploying PWR technology by the Koreans, had a much more successful outcome in terms of schedule. I am not familiar enough with the challenges in these other two projects other than to say that those challenges can manifest themselves from regulatory interventions, from construction challenges and inexperience in the construction workforce; they can manifest themselves in the engineering sequencing of completing engineering after you have started to pour concrete—all of which are programmatic challenges that if you get the sequence wrong will create significant impacts and delays. They are attributable as much to the challenges of those projects as to the actual technology at the core of the reactor itself.

Lord Forsyth of Drumlean: To take an analogy, you are competing with EDF and others. You are telling us that you have a Rolls-Royce, and the impression we are getting is that the other lot are trying to sell a Trabant. You are saying that it is not actually to do with the nature of the vehicle; it is to do with the way it has been put together. Is that what you are saying?

Mr Tom Samson: That is the analogy I am trying to highlight to distinguish between the technology and construction. It is not the nuclear technology at the core of the reactor that is different. It is the constructability and deliverability.

Lord Forsyth of Drumlean: It is the competence of the execution.

Mr Tom Samson: There is a variety of challenges. EDF has pioneered this effort to get to Hinkley's FID and is now building its project. I wish EDF well and I think an important aspect to this industry is that we support its ability to deliver that project on time and on budget. It is a lead project in the UK, so we want EDF to succeed. If you look at the reasons why projects fail or have delay and cost overruns, it is usually attributable to factors such as regulatory risk, engineering and supply chain performance. They are the things that we have assessed, as NuGen with our Westinghouse partners and Toshiba, based on the eight projects the first of which is approaching fuel load, to ensure that those experiences and those lessons are built into our project so that we can deliver it with confidence.

Lord Forsyth of Drumlean: Finally, if you were doing a project, would you give a commitment that you would not come back for more money if things went awry?

Mr Tom Samson: It is important that the project venture—NuGen in this sense—has confidence and a commitment to deliver. That is not just a statement of words; it is backed up by facts, evidence and proven experience.

Lord Forsyth of Drumlean: That is a no, I think.

Q86 **Lord Darling of Roulanish:** In your evidence you mentioned the funding gap; you said it was formidable and gave various other descriptions of it. Is that because the funders do not yet have in front of them a proposal that they can possibly fund because you have not finished all your work yet, or is it because the funders are inherently sceptical or reluctant to get into funding nuclear power stations?

Mr David Stearns: With respect to the debt markets, there is very little appetite that has been evidenced in terms of support for nuclear renewable projects. These are new assets, new projects, new risks, for lenders, bond holders and export credit agencies as well.

Lord Darling of Roulanish: It is the very idea they are not keen on.

Mr David Stearns: I would not say they are not keen. I think they need to understand. They are prepared, and we have found that there is a market that is willing to listen. If your name is Hitachi—I suppose it is the same with almost any developer or blue chip Japanese shareholder—you will attract, naturally, the export credit agencies, the house banks and a certain number of potential bond holders. There is a learning process.

Mr Tom Samson: There is an element whereby you have to develop a deal structure that is bankable if you are going to look for debt, and that requires you to have a contracting structure in place with an EPC consortium that you can allocate some risk to and hold accountable to deliver against. That is slightly different from the Hinkley model where there is no single EPC entity. That is a difference that allows us to structure the deal differently and present something that is more attractive to potential lenders and investors.

I would agree with David that this is not a traditional, commercial, financeable venture, where you go and talk to the likes of Barclays or Citibank and ask them to give you money; but you have conversations with export credit agencies where there is content and strategic rationale for supporting the export of technologies, and you look to build on that with a confident delivery plan to attract other investors. It is incumbent on us to deliver that narrative and to secure that participation, and those are conversations that we began and we need to complete over the next 12 to 18 months.

Lord Darling of Roulanish: So that we can get this in our minds, when are you talking about getting the first shovel on the ground if all goes reasonably well, and when would we expect the thing to be completed and providing electricity?

Mr Tom Samson: As a private-led development effort, we are not able or planning to begin construction until we have the financing in place, other than maybe some brief enabling works. We expect to achieve that financial close at the end of 2018, and 2019 would be the point at which we would begin the construction effort up in Moorside. The aspiration based on our current planning is to load fuel in that reactor at the end of 2025.

Lord Darling of Roulanish: It is about eight years.

Mr Tom Samson: Yes, roughly.

Mr David Stearns: It sounds as if we are on the same schedule with the Wylfa project for Horizon.

Lord Turnbull: Who is going to generate the first megawatt of electricity?

Mr Tom Samson: Many men have sat here before me and predicted those bold statements and lived to regret it. We are certainly committed to being done by the end of 2025.

The Chairman: Gentlemen, thank you very much indeed.