

Select Committee on Science and Technology

Corrected oral evidence: Priorities for Nuclear Research and Technologies

Tuesday 28 February 2017

11.45 am

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Members present: Earl of Selborne (The Chairman); Lord Broers; Lord Hennessy of Nympsfield; Lord Hunt of Chesterton; Lord Mair; Lord Maxton; Baroness Morgan of Huyton; Lord Oxburgh; Viscount Ridley; Lord Vallance of Tummel; Baroness Young of Old Scone.

Evidence Session No. 4

Heard in Public

Questions 31 - 37

Witnesses

Jesse Norman MP, Minister for Energy and Industry, Department for Business, Energy and Industrial Strategy (BEIS); Professor John Loughhead OBE FREng FTSE, Chief Scientific Adviser, BEIS; Craig Lucas, Director of Science and Innovation for Climate and Energy, BEIS.

USE OF THE TRANSCRIPT

This is a corrected transcript of evidence taken in public and webcast on www.parliamentlive.tv.

Examination of witnesses

Jesse Norman MP, Professor John Loughhead and Craig Lucas.

Q31 **The Chairman:** Could I extend a very warm welcome to the Minister and his two colleagues who have joined us for this, the fourth evidence session. We are returning to matters nuclear and nuclear research specifically, having done a number of reports over the years, most recently in 2011. We are being broadcast, so I wonder if the Minister could introduce himself, for the record, and then his two colleagues introduce themselves also. If you would like to make an opening statement, please feel free to do so. Mr Norman.

Jesse Norman: Thank you very much indeed, my Lord. Thank you to the Committee for inviting myself and my phalanx of official colleagues to answer your questions. My name is Jesse Norman; I am the Minister for Energy. I must say I am slightly depressed by the fact you have included John's various professorial degrees and titles but not Craig's or, indeed, my own. I wonder if that is an inherent bias towards engineering and science in your approach.

Professor John Loughhead: We hope so.

Lord Hennessy of Nympsfield: Perhaps you had better list them.

The Chairman: Put them on the record.

Jesse Norman: Certainly not; they have nothing to do with what we are talking about.

The Chairman: That is probably why it is not on your name plate.

Jesse Norman: Touché.

Professor John Loughhead: Good morning. My name is John Loughhead; I am chief scientific adviser at the Department for Business, Energy and Industrial Strategy.

Craig Lucas: Good morning. My name is Craig Lucas; I am the director of science and innovation for climate and energy at the Department for Business, Energy and Industrial Strategy.

The Chairman: Thank you very much. Lord Ridley would like to start.

Q32 **Viscount Ridley:** The industrial Green Paper came out recently and it included the Hutton review on competitiveness and skills in the nuclear industry. Part of the early work from that is supposed to result, we understand, in a sector deal for the nuclear industry. Could you explain how the nuclear sector would benefit from such a deal and what a sector deal might usefully include?

Jesse Norman: Sure. Maybe I can kick off on this and invite colleagues to comment. We have just had a meeting of the newly reconstituted Nuclear Industry Council, which is chaired by myself with Lord Hutton. That has focused on the idea of a nuclear sector deal. The Committee will be aware we have thought quite hard about whether or not such sector deals are an important part of industrial strategy, and they have various

potential uses. Let us not forget, this is the industry coming to government with a proposal that is in its interest, which we can somehow support and facilitate in government.

The overwhelming interest that we in government have—and I think the industry shares—is twofold. First and foremost, it is to reduce its costs and, in so doing, to reduce risk in the supply chain, to build capacity, in due course, not merely to supply domestic needs at lower cost but to open up export markets for its skills.

The second is skills themselves. Obviously, that has been a significant focus of the Committee's work and of our interest. That is maintaining skills in three areas; not just what you might call the highest-end research and development, which is often about a particular professor or academic with PhDs, et cetera, around them, but what you might call the vast bench strength of engineering skills that sit across the sector. A particular interest of mine is recycling and improving the skills of the workforce as well as bringing in new talent. I particularly have in mind the result of the decommissioning of the AGR fleet. We will have a lot of quite skilled nuclear engineers, and it would be rather good to find ways of improving their skills, repurposing and targeting them and then deploying them elsewhere in the industry. Those are the two key focuses of the sector deal we are discussing.

Baroness Young of Old Scone: I was going to ask a question about whether you think the players in the nuclear industry have enough oomph to do what you described: the industry coming to government with a proposal. My experience is more with the aerospace sector, where we have a lot of very proficient pushy players who are capable of doing that job. The way you described the sector deal was very immediate and tactical rather than strategic. I am thinking that there is probably enough oomph to do that job, but who is going to do the job of looking forward 10, 20, 30 or 40 years to what the industry, the skills and the deal needs to be for the future?

Jesse Norman: Thank you for that. I am also the Minister for aerospace—that is my one remaining industry segment—so I have some point of comparison between the two sides. I would not describe anything I have said as remotely tactical. The question of how you build skills is a long-term question. The question of how you build capacity and reduce costs in an industry which thinks typically in decades, is a long-term question. So I am afraid I would disagree with you on that aspect.

There are players with oomph on all sides of the equation in the nuclear area. We obviously have the EDFs and the new builders who have potentially significant sway, but we also have a decommissioning industry and players in and around government who, I take it, have significant oomph—although I am not quite sure what you mean by oomph. In fact, in a way the problem is the opposite problem. The problem is that you have some very important interests around the table, all of which deserve to play a part in a wider deliberation: you have technology, industry and government. The question for government is how you knit those together into a strategy that delivers on behalf of the taxpayer and the nation as a

whole. In a way it is not so much whether each of them has oomph but whether or not they can be brought together in a way that delivers a comprehensive package for everyone. That is what we are starting to focus on with the issues of cost and skills. I do not know if colleagues want to come in on any of that, but I would invite them to.

Baroness Young of Old Scone: Is it the sector's job or government's job to look for the long-term strategy?

Jesse Norman: It is government's job to preserve the long-term interests of the country as regards industrial strategy, taxpayer value, research and innovation and all the other aspects. The issue of strategy is a more complex one than, I think, is sometimes realised. There are some areas in which you can say, "We more or less know what the field of operation is and we can be therefore very clear about what the strategy might be"—we can hold certain things as parameters and within that we can operate a strategy. In the case of nuclear you have several things that make that harder than perhaps it should be. One is existing players, who inevitably have a tendency to defend their own interests. A second is rapid technological change outside the industry, which is constantly raising the question of, as it were, cost within the industry. The third is a question of technology change in so far as it affects the energy mix and, therefore, the scale of deployment of nuclear technology as part of a wider conception of what energy supply ought to look like. Of course, another one would be changing demands for the potential sale of technology or skills overseas. All those things go into the picture. As you know, we did, in fact, produce a nuclear energy strategy in 2013 in which many of those issues were reflected.

Lord Vallance of Tummel: Passing comment, I cannot let it go by that the one company you mentioned specifically that had oomph was EDF, which of course is French and which, together with AREVA, which is the manufacturing side in France, forms a cornerstone of French industrial strategy in this area. Is it compatible to have French industrial strategy lining up with ours? How does it all fit in that way?

Jesse Norman: I do not see that there is an enormous tension. One of the questions raised in your deliberations as a Committee is the question of whether we should be a kind of world-class technology-owning nuclear power or a third-class technology-using nuclear power. I am afraid I regard the premise of that question as misguided. The reason for that is that we have had times in the past 40 or 50 years when we have been a technology-owning power. We did it with Magnox and with AGR. I would invite any member of the Committee to tell me a successful export using that technology. It does not look as though either of those technologies had any of the export potential often claimed for them. In fact, there is one, which the Committee may be aware of; it is a North Korean reactor that was pirated using Magnox technology. So we have a potential future use for our decommissioning skills in Magnox in North Korea, if we choose to use them.

Lord Hennessy of Nympsfield: That is a bit unfair. We sold two Magnoxes to legitimate powers. One was to Italy and I forget where the

other one was. Was it Japan?

Jesse Norman: Then we have two more. We have since had an AGR fleet. My point is we can get very taken up with the ownership of technology, but a lot of the value of the technology lies in all the ancillary things you put around it. As regards the ownership of the technology, if one looks at some of the current owners, they are not absolute bywords for profitable, successful companies.

Lord Hennessy of Nympsfield: Point taken.

Lord Maxton: If you do not mind me saying this, Mr Norman, you are the Minister for Energy only for England; you are not the Minister for Energy for Scotland, which has turned its back completely on nuclear energy. The AGRs in Scotland, of course, will be closing. Are you going to attract these skilled people from the AGRs in Scotland to work in England?

Jesse Norman: I would hope that there would be the opportunity for people with expertise and skills in any AGR to work wherever in the UK they felt their skills would be best deployed.

Lord Maxton: They are not going to be working in Scotland any more.

Jesse Norman: If the Scottish Government wish to use their skills in other ways, it is fully up to them to do so.

Lord Oxburgh: Do we have a civil nuclear strategy at present?

Jesse Norman: Yes. We published a nuclear strategy paper in 2013.

Lord Oxburgh: Does that hold good today?

Jesse Norman: It provides a basis. For the reasons I have described, the issue of strategy is a rapidly shifting one and we have to be careful to keep it up to date. We have just published a wider industrial strategy, which I am sure the Committee will recognise, and you will recognise, Lord Oxburgh, is a pioneering attempt to articulate the principles which ought to be guiding wider economic activity in its biggest sense, and those of government alongside it. It may be, in due course, that we want to refresh our energy strategy within that framework but, at the moment, the nuclear strategy remains what it is.

Q33 **Lord Oxburgh:** Whether one is talking about a nuclear strategy or a broader industrial strategy, there is a question of timescale. I have to say I was not entirely clear from the industrial strategy, when one is talking about value for money and taxpayers and so on, what length of view it is appropriate to take. The reason for emphasising this is that the timescales associated with heavy engineering—and a lot of nuclear is heavy engineering—are long. They are not one Government long; they are two Governments, three Governments or four Governments long. We cannot afford to chop and change, so we need something which is as widely agreed as possible to carry us through in the longer term. Are we anywhere near that?

Jesse Norman: I think, my Lord, you are sounding like an advocate for the Government's policy. Having published the industrial strategy as a

Green Paper, as a consultation document, and having had a series of ministerial visits around the country to promote it and seek local input—and doing it in an entirely nonpartisan way, designed to elicit support from other political parties and, indeed, from people of no political party—the Government’s policy is designed to build precisely the kind of longer-term consensus about our economic policy that can properly undergird several changes of government, if necessary.

Lord Oxburgh: How does the Nuclear Industry Council fit into this?

Jesse Norman: The industrial strategy leaves scope within it for different deals to be struck with sectors—as indeed deals can be struck with cities or regions, as with the Midlands Engine for Growth, the northern powerhouse and the Aberdeen City Region Deal to support the oil and gas industry, et cetera. This is a sector deal that could sit within that perfectly happily.

The Chairman: Could one of your advisers, if not yourself, tell us when the Nuclear Industry Council last met?

Jesse Norman: Last week. I chaired it. Luckily, although I have an appallingly bad memory, I do not need a prompt.

The Chairman: I was not expecting you to have a total recall of that. How often does it meet?

Jesse Norman: It had become too large, by common consent, and was not functioning as effectively as it might. One of the decisions we took with the new Government, as a new department, was to attempt to rebuild and reconstitute it in a way that would make it not merely suitably representative but more effective. This was the first meeting we had under those circumstances. We were going to have an earlier one but parliamentary business intervened and I was insistent that I should be there because I think it is very important for government to give a lead alongside the industry in these things. The current expectation is we will meet two or three times a year, I think; more when we have business to decide, to frame issues and get some specific accountability into the system and less, perhaps, when we are running a project. It has a very able secretariat in the form of the Nuclear Industry Association, so there will be a lot of continuity, we expect, between those meetings.

The Chairman: Do you see it as the organisation which might lead on the sector deal which has been referred to in the strategy?

Jesse Norman: I think it is the right forum for a sector deal. A sector deal, by its nature, could come from any industry forum or body, but that is the most wide-ranging and, therefore, fits most naturally into that remit. I certainly hope it will.

Lord Hennessy of Nympsfield: Jesse, you are a scholar politician with more than a dash of vision, if you do not mind me saying so. Do you see the hills humming to the sound of small modular reactors in our future? Are you an enthusiast?

Jesse Norman: As you know, we are in the middle of a competition on this issue. I do not want to get ahead of that, but I would say that I am a

loving man from the state of Missouri. The state of Missouri is "The show me state" on its number plates. I love the industry and I love the projects and ideas, but I want to be shown the value. That may fall into one of two categories, and there are lots of potential ideas out there. One category is the ones that are, as it were, nearest to market, and there my question is, "Show me the market; show me the route to market". Or there might be ones that are a long way away from the market—generation IV and advanced type reactors—and on those, to me, the question is more about science and technology; it is about research and what contribution they can make to the way in which we are thinking about it. I am not a scientist myself, although I have taught the philosophy of science, but I have a great interest in having a successful, effective research base. I also think that alongside that there has to be a lot of other activity that has a more utilitarian justification.

Lord Hennessy of Nympsfield: I think we were due a statement, were we not, in November, on the competition, which did not happen? Am I right?

Jesse Norman: I do not recall the detail. There certainly had been an expectation that it would be finished by the end of last year, but the change of Government and one or two other things that you may recall last year had the effect of disturbing the timetable somewhat. But we are certainly hopeful of getting it back on track, in terms of an announcement, relatively soon.

Lord Hennessy of Nympsfield: Before Easter?

Jesse Norman: I am not going to be drawn because I have seen that sharks can lie in those infested waters.

Viscount Ridley: Can I follow up on that? One of the dangers in announcing a competition but then not being able to announce the result of it is that you have, effectively, paralysed work in some of these areas. Not you personally, but the Government have. It is very difficult for anybody to talk to Ministers about it to find out the way of thinking because you are sub judice, in some sense, and there is a feeling of, "We might have worked a bit faster if we had not had this competition hanging over us".

Jesse Norman: I do not think that that is impossible. I do not think it was perfectly named as a competition; it was more a kind of call for ideas across a much wider spectrum. I will ask Craig to say a few words on this, and John, if he wants to, but we have not, as far as I am aware, had a lot of pushback about blight. I do not know, Craig, whether you want to comment on any of this.

Craig Lucas: We are very sensitised to that risk, if you like. I would also say that this is a very complicated area and the range of things that has come forward to us has meant we have had to do a lot of thinking about the evidence presented and what is a viable proposition and what is not. The long-term nature of this decision, to some degree, justifies the level of effort we have been putting into it, I think.

Lord Hunt of Chesterton: Is this plan for modular reactors, or indeed

your plans generally, very British-centred? We have had evidence this morning from a colleague from EDF Energy, which has a research capability in Britain which is growing very large. He and indeed the officials from nuclear safety were commenting on how we can, could and should be developing a very significant collaborative programme with France. Is that part of your thinking?

Professor John Loughhead: On the research and technology side there is quite extensive interaction already. I have had a couple of meetings with the chairman of CEA talking about those complementary areas where the UK and France can best support and exchange information with each other; there are commercial contracts that some of the bodies such as NNL have and there are some commercial contracts for provision of equipment that span both countries. That is the case. If you are talking about more adventurous longer-term reactor design, I think that requires more consideration over which companies might be taking the lead in the development and marketing of such systems.

Jesse Norman: I do not know if Craig wants to say anything, but to add to that, the competition was open to all comers; it was not a nationally drawn competition that restricted itself to UK technologies only. I think there is scope, without risking vision, for a bit more imagination in this area. If, for example, EDF, as you know, which manages our existing AGR fleet, were to come to government and say, "We wish to commission a new kind of small modular reactor design as a successor to AGRs and we will put four or six of them on each site and we would like to have a conversation with you about technology and development", that would be a topic of great interest to us. We would have that conversation with them with alacrity. The point of this is to allow ideas to flourish. That includes commercial ideas as well as research ideas.

Lord Broers: How are you going about assessing all of these alternatives? I know there is a lot of industry out there talking about it, but have you assembled a highly competent engineering-based team to advise you on how to assess this competition?

Jesse Norman: The best thing I can do is hand over to my highly competent engineering-based team.

Craig Lucas: Perhaps I can kick off and you can add. There is an engineering-based assessment. We have done an extensive piece of evidence work to look at the state of maturity of the different technologies and the likely level of costs they might achieve. One of the things that comes out of that is that the possible technology outcomes are of a very wide range, which reflects the relative maturity of the sector. Therefore, in assessing that, we not only need to look at that question but the question of investability more broadly and the question of the amount of value that UK plc could capture. All those factors are in play in what we are looking at. I do not know if I have missed any key point there, John.

Professor John Loughhead: The only point I would join is that the expertise that has been brought to bear has come from both within and

without government resources. There has been quite a lot of use of industry expertise in making that assessment.

Lord Broers: You are looking at this as a high-priority item, because it is moving very fast, of course, as you know, especially in China and other places. If we want to get in on a deal we cannot sit around in a grand British way, considering it for too long and being too sure of everything; we have to get in there and do something.

Craig Lucas: I might respond that all R&D investment is a calculated risk. That is the nature of the investment. It is a question of being in a place where you are sufficiently clear that the calculated risk is reasonable, I guess.

The Chairman: Did you want to add anything, Professor Loughhead?

Professor John Loughhead: No, I am just delighted to hear that Lord Broers has witnessed a nuclear industry moving with alacrity and speed.

Jesse Norman: Anywhere in the world. You said China, where it is doing so. Of course, China has certain advantages in the way it deals with possible disagreements about energy policy over our own Government. One other thing to say is that that view assumes that it is clear what has to be done. That is to say, if one takes as an assumption that there is—and I am not saying there is not—a technology that is ready to go and that failure to implement it is therefore a potentially culpable act on behalf of government, and if that turned out not to be so, the viewpoint would be undermined as a result.

The Chairman: Can we move on to skills, and Lord Mair?

Q34 **Lord Mair:** I want to ask about skills and about R&D. I guess my question is to Professor Loughhead. What should the Government or your department do to better co-ordinate R&D in the nuclear sector? There are lots of different bodies, as we know, doing various pieces of research. Do you think that that should be better co-ordinated in some way and that your department is probably the right one to do that?

Professor John Loughhead: There are a number of different funding organisations and there are a number of different actors in the scene. There are two areas where, in recent months, there has been a greater ability to co-ordinate. First, following the recommendations of this Committee some years ago, an advisory body was set up which gave advice on priorities and content of programmes. That, if you like, is the top-level strategic issue. We have subsequently, in the last nine months, set up within government the Energy Innovation Board which provides a cross-cutting prioritisation and direction into those energy innovation activities, including nuclear—not restricted to nuclear—which informs the different public sector funders. Then, of course, there is R&D that is conducted through purely commercial resources, over which we have no direct control—but, through dialogue within the community, we hope that they will be better placed to select where they put their money.

Lord Mair: Does it seem very disparate, with lots of different parts of different bodies doing research? We heard earlier this morning from the

EDF witness. It seems very different in France; it seems to be much better co-ordinated and directed from an R&D point of view.

Professor John Loughhead: We operate a very different system in the UK to that in France, where it is a hierarchically controlled and centrally directed programme. That is not the case here. However, going back to what I just mentioned, I think there are mechanisms in place which provide both a prioritisation process and a means within which decisions on particular facilities can be made. We have the normal research quality assessment as well, which is an important point. It is a more distributed system, but I would say that it is probably not accurate to deduce that, therefore, it is totally fragmented and unco-ordinated. That is not the case.

Lord Mair: Can I follow up on skills, which is related, I think? What do you think should be done by the Government to promote and ensure that the right skills are available?

Professor John Loughhead: Is this skills in the sense of skills for research or skills for the industry overall?

Lord Mair: Actually, both.

Professor John Loughhead: Perhaps I will answer first on the research skills. There has been for some years now a research council-funded programme to maintain an activity and a training programme in the nuclear space. That was expanded approximately five years ago with the formation of doctoral training centres and other programmes which have added to that landscape. The programmes have expanded in recent years. The information we have is that the flow of graduate level and postgraduate qualified engineers, scientists and other nuclear skills coming out of that has increased. Whether it is sufficient is a little bit of a challenging question. I rely on the laws of supply and demand. There is a demand for people now to go on these training courses and that demand is being met by the provision that is being made. It is very difficult to predict exactly what numbers will be required five years in the future.

Lord Mair: Our witnesses earlier this morning were pretty clear that there was a problem: that there were not enough skilled people being prepared for whatever our nuclear industry develops into.

Professor John Loughhead: In the research space?

Lord Mair: Both.

Professor John Loughhead: Okay, I have not addressed the second point. I do not know whether you wish to say anything about the more general skills question.

Jesse Norman: I am perfectly happy to do that. We have Fiona Rayment looking very closely at the question of the skills needs of the industry, and that ranges across all of the three categories that I described earlier but with a particular focus on, as it were, the more working engineering skills. On the R&D side, we are continuing to invest at an extremely high rate in the nuclear industry. Government spending in the year 2015-16 was £120 million on nuclear research. That is going up at the moment.

We have just announced an enormous increase in overall R&D funding which is biddable into the Industrial Strategy Challenge Fund by the nuclear industry. So there ought not to be any absence of opportunity for research-based projects to bid for funding that can sustain the skills required in the key areas.

Craig Lucas: When you look at the way that nuclear projects are structured and delivered, it is a quite labour-intensive model. When we look at innovation and some of the areas of innovation that are identifiable as an opportunity, they will require a different skill mix and they will require fewer higher-skilled people and higher GVA per head and all the rest of it. It is important that we do not bake in the existing assumptions and approach, where R&D and innovation might find different ways of working that will require a different skills base. To some degree, investment in R&D informs that as well.

Lord Hunt of Chesterton: We discussed this morning the question that part of it is training and there is research but there is also, in some sense, the vision thing, as it were. When you think about how universities got engaged in some of the big environmental issues 10, 20 or 30 years ago, there are some big universities which do not have a significant major nuclear programme: there are no students pouring into this area as one of the most exciting areas. Nor in the universities is there a connection between fusion and fission, and some of the most exciting ideas are bringing these two together. Euratom was involved in this, and so on. One of the questions is pulling all this up into an exciting future. At the moment, there are not enough universities, just to give an example based on what I observe, as engaged in this as they should be and, therefore, not enough students are becoming interested in it. It is partly money, which the Minister has mentioned, but there are also some other factors involved.

Jesse Norman: I was making the opposite point; I do not think it is about money. There is plenty of money swilling around the system. I do not think every university should feel it is under a national obligation to undertake nuclear research. Inevitably, people will be skilled in different areas. In a way, my Lord, I want to ask you: what counts as “enough”, as in “not enough money” or “not enough is being done”? I can understand what “not enough” means when Fiona Rayment comes to me and says, “We do not have enough bench strength in this area to support this”, or Paul Howarth comes to me and says, “In the National Nuclear Laboratory we are short of people with specific expertise in X, Y, Z, P, Q, R”—but I am not sure what is meant by “enough” as a general matter. How much is enough? Potentially we could spend £1 billion and some people would still be saying it was inadequate.

Lord Hunt of Chesterton: If you look at the paper we had, for example, from Professor Lee at Imperial College, it was pretty critical written evidence along those lines. Obviously, the Government have a big fission programme and they also have some fusion programmes. I have talked to Professor Loughhead about this. We are investing a lot of money, Europe is investing a lot of money, the private sector is pouring money in—and I declare an interest—to new kinds of fusion, which has a

timescale not dissimilar to the fission timescale. At the moment, there is not enough; there could be more to engage, and this could become a more central part of the whole British technical scientific programme. At the moment, we have our fusion programme, our fission programme and the industry thing whereas in France, as we heard this morning, they get together—the French President is there, for God’s sake—they have this committee and they have the CEA, which is like the old Atomic Energy Authority. We used to have the old Atomic Energy Authority; half of them were in the House of Lords at one point. It was different. We do not have that push.

The Chairman: Before you address that, could we hear from Lord Vallance and Baroness Morgan and put them all together?

Lord Vallance of Tummel: To get into the quantities for a moment, could you let us know how much is spent in the UK on R&D in this area from the public purse and the private purse?

Jesse Norman: Very happily.

Baroness Morgan of Huyton: I am sorry; I forgot to declare an interest earlier on. I am a member of the Council at King’s College. Can I widen this away from money? Lord Hunt was talking earlier not just about money but the vision coming from government to excite the next generation. When I think back to when I was a teenager, nuclear power and the whole story seemed incredibly exciting and very captivating, I think, for that generation. Certainly my impression now, in the school system, is that nobody talks about this, and it is a pretty narrow group of people who decide to take this further at university and beyond. I am interested in hearing from the Minister about whether he thinks that there is a role for government in engaging and providing a story and a vision to captivate the next generation in this area. I feel that is missing.

Jesse Norman: Sure. Every generation is going to have its particular areas of focus, and for this generation they tend to be consumer electronics and Google, and all the things that go along with that.

Baroness Morgan of Huyton: The environment, green energy. In a sense, one could argue we missed a bit of a trick.

Jesse Norman: I would put it the other way round, which is that this Government are doing more to support technology, engineering, careers, training and education. With a decent following wind, next week they are going to announce support for a project very close to my heart, which is a specialist technology and engineering university in Herefordshire. If that comes off that would be marvellous; that will be a complete upending of a lot of existing ways in which we think about how to teach those subjects. There is a tremendous emphasis in the school system now on the preparations for those subjects through mathematics and the sciences. That is not to say that I do not think government could do more to enunciate the value of the white-heat technologies as regards nuclear, because I think that is true. I do not feel bad about what the Government are doing to encourage people into technology and engineering degrees at the moment because it is probably as much as any Government have

done in living memory. I do not know, Craig, whether you want to add something.

Craig Lucas: I will add a couple of factual things. We track the skills area through the NIRAB landscape survey. In overall terms there has been an increase in the nuclear research base since 2011-12 of about 15%. The largest increase has been in universities, but the configuration of which universities fund what is changing. In some senses, that is not necessarily a problem because the skills mix and the needs are different. For example, there are emergent areas such as robotics and autonomous systems which require different skillsets. So to some degree there is some quite positive stuff in the landscape, and some of that is an inevitable product of the industry changing and modernising.

On the spend point, the total sector spend in 2015-16 was around £215 million. We do not have a fully accurate figure for private sector spend but, as far as we can identify, there was £41 million of self-identified private sector spend in that number, and £54 million from overseas, which is mostly for fusion funding. We are making up the balance. The Government are doing the heavy lifting in that regard.

The Chairman: Could we move on to the NNL? Lord Hunt.

Q35 **Lord Hunt of Chesterton:** Can you explain how the NNL's role is leading in this country? As I have mentioned, we have a different approach from that of France, as we heard this morning. I wonder whether, Minister, you would like to explain.

Jesse Norman: Again, I am more than delighted for Craig and John to join in, but the thing about the NNL is that there are several sets of potential things one could say. First, the NNL has proved to be a great success. That is the first thing. It now has something like 25% of its funding from non-government sources and the majority of the funding it gets from government sources is competed. So that is a great success. Obviously, it is at the industry end of nuclear research. Of course, we also have the UKAEA, which is at the, as it were, scientific and academic R&D end of nuclear research. Within the NNL there are potential conflicts between the commercial imperative it faces and a role for government. I think those are more potential than actual at the moment, but we are undoubtedly—and this Committee has been very helpful in that regard—thinking, and have been for some time, about the best way to preserve an independent advisory function for government versus what you might call, on R&D, a wider, general remit.

Before I invite my colleagues to comment, let me say one other thing. One of my focuses, as a Minister, is something that is implicit in this but I do not think it has been mentioned in the Committee, which is how government can become a better client. When infrastructure projects fail a large part of the reason, in many cases, is because they have a very bad client. I spend a lot of time, as the Committee may know, essentially arguing for a different approach to reducing costs in PFI projects which the Government inherited in 2010. I persist in the view that, if they had taken a different approach earlier, the Labour Government could have

saved an enormous amount of money in the way they procured that infrastructure. The reason they did not is because in many cases the clients involved were very bad clients; they kept changing their minds, they were not clear about what they wanted and they were very producer-led—bells and whistles and all this kind of stuff. One of the tasks for government, as I see it, is to become a better client; to be better not just at strategy, which the Committee has very helpfully focused on, but better in how it commissions and manages. This fits into that wider picture. I thought it might be useful for the Committee to know that we were thinking at that level as well.

The Chairman: Would core funding help NNL in its role, which is not only to do applied research—commercially relevant research—but to have an advisory role of a long-term nature?

Craig Lucas: That is an issue we are actively considering. We have used NNL in a small way for the secretariat function for NIRAB. We found that to be a very effective and useful thing to do. We are thinking about how we could evolve and grow that so that we could access other areas of expertise quickly and easily, but it does involve the NNL taking on some different skills as well. The skills of running high-value laboratories are not necessarily the same skills as some of the other strategic questions we need to answer.

Jesse Norman: John, would you like to come in?

Professor John Loughhead: No, I think that covers everything.

Jesse Norman: I would add a couple of grace notes to what Craig has said. The key, to me, is to be deft about this. We do not want to be building another, as it were, player in an already complex jigsaw puzzle if we can get the value of the advice independently delivered in a way that supports objectives at low cost. It is also important for me to place on record our thanks to NIRAB for the work that it did and to Dame Sue Ion for the leadership that she gave it. That was not, by any means, an easy process, and the fact they came out with a report given, in many cases, quite divergent views and interests and a rather large group of people was a very significant achievement, in my view.

The Chairman: Can we move on to SMRs and Lord Broers?

Q36 **Lord Broers:** We have talked about this a lot. On the problem we have been talking about of inspiring young people, some of those giving evidence to us did bring up the fact that, if you want motivation, things such as putting a man on the moon inspire people. SMRs might offer that opportunity for us. Minister, you have pointed out that the nuclear industry has not been the most profitable in the world, but in the future things might get better and there might be sectors where we could perform. With our base, a lot of us have felt that SMRs might be an initiative that could be a sort of “man on the moon” initiative and inspire the industry and get young people, teenagers, to see this. After all, to almost all of us engineers there is only one solution to the CO₂ problem if we are going to meet our goals: we must have nuclear—and modular nuclear might be a very effective way to do this.

Jesse Norman: I do not think I commented on the industry's profitability, only on whether it was a profitable strategy for government to be involved in technology ownership in the nuclear area. I think there is a mixed record on that front, to say the least. Many other areas of the industry can be successful and profitable, and indeed the global exports for us over time in decommissioning and reprocessing are obvious areas.

On the issue of SMRs, I would be delighted to have a world-class SMR technology that could be tested in this country, developed in this country and rolled out around the world on a competitive and cost-competitive basis. As a Government, we remain very interested in that possibility. If we are talking about SMRs that are close to market, I would like to see where the markets are before I invite my colleagues to commit the first pound of British public funding to it, over and above the enormous and increasing amounts of money we already invest in related nuclear R&D. That is the process we are looking at, at the moment.

The Chairman: The amount of money dedicated to civil nuclear research was lower in 2015-16 than the level in 2010-11.

Jesse Norman: I do not have the numbers in front of me. I cannot comment on that.

The Chairman: It is not a fair representation to say that these are vast sums, but I take your point that you want to get value for money.

Jesse Norman: I think I said that the Government were committing vast sums. I think the Committee would agree that £120 million of total government nuclear research last year is a significant amount of money. The £2 billion we have committed to additional innovation and support for the industrial strategy is a significant amount of money and all that is available to nuclear R&D to bid for in various forms.

Viscount Ridley: I want to press one more time to try to pin down a rough date as to when we will hear more on the SMR question. I know you have had a go at answering that, but would you mind having one more?

Jesse Norman: I have not had a go at it, but I have given you an answer, which is I am not going to give you an answer but it will be as soon as we can do it. That is a perfectly clear answer. It may not be the one you want but it is a perfectly clear answer.

Lord Hennessy of Nympsfield: When you used the phrase "a complex jigsaw puzzle" a moment ago, I could see the ghosts of many, many Ministers past behind you. It has been 72 years since the first Cabinet committee was set up to bring coherence and strategy to all of this. Why have we, one generation after another, made such a horlicks of it? Why can we hope that your generation will de-horlicks it?

Jesse Norman: It is a very interesting question as to why nuclear energy has proceeded in a stop-start fashion over time. There are very few countries which can claim to have got this right. It is not absolutely clear to me, by the way, that other countries that have claimed to be great success stories would, in retrospect, regard their view as having

been the right one. They have often not faced the kind of democratic pressures that British Governments face and they often have spent an enormous amount of money to achieve what they have tried to achieve. Do not forget, if I may say so, that there are other aspects of British energy policy which have been conspicuously successful, but not in the nuclear area. By the way, as the Committee will know, we remain at the forefront of any European nation in terms of the reductions in carbon emissions we have achieved over the last few years. So there is a lot to be proud of overall. However, we have migrated towards a strategy which is designed to manage risk. These projects are large, very expensive and very hard to build. A risk-averse strategy is not necessarily a bad one, under those circumstances.

Lord Maxton: The answer is "politics".

Lord Vallance of Tummel: I wonder if you could tell us a little bit more about the criteria you use. There is a competition, and you are not going to tell us when that is going to come out, but you must be able to tell us the criteria you use in assessing the risk of particular projects.

Jesse Norman: Craig, I think that is one for you, old friend.

Craig Lucas: I partially answered earlier but, to elaborate, there are two classes of project clearly emerging in this process. One is the relatively mature near-to-market type of project, which is a technology we can understand and quantify. On those you can look at what their likely route to market might need to be and what the likely market size might need to be for them to achieve the cost reduction that they would need to achieve. By the way, that market would have to be a global market; we are not a sufficiently large market on our own to do that. Then we can consider what the industrial content for that might be.

If we look longer term at the more advanced technologies, I think different criteria apply and we can be more focused on their research merit, per se, and what value that IP might create for UK plc overall.

Lord Vallance of Tummel: What proportion of government investment would go into these very different types of project?

Craig Lucas: That will form part of the decision we make.

Lord Vallance of Tummel: We do not know the risk appetite, in other words. You would know what the risk appetite was if you were going to say, "Yes, more than half is going to be in the long term and less than half in the short term". We are not there yet.

Jesse Norman: It is a perfectly fair comment. As I mentioned earlier, the thing is not to get too hung up on the word "competition". When the previous Government used the word they implied that there was a level playing field, a stable set of technologies and, as it were, people would compete. Therefore, apples would be measured against apples in terms of output, technology cost, degree of local content and all the other things. We are discovering that we have apples, oranges, pears, pomegranates and a large number of other things. It is a very interesting exercise from the Government's standpoint because it reveals a lot of

latent information in the market, but it is not necessarily a helpful exercise from the point of view of running a competition because it becomes very hard to trade off in an authoritative way what the differences are.

The Chairman: Baroness Morgan, did you want to come in on this or have we dealt with it?

Baroness Morgan of Huyton: I wanted clarity. When you refer to the approach of the previous Government, are we talking about David Cameron's Government, the coalition Government, or are we talking further back? I am not being difficult; I do not understand the period you are talking about.

Jesse Norman: Sure. In this case I was referring to the Government at the time when the competition was launched. That is to say, what was going through their mind when they launched the competition.

Baroness Morgan of Huyton: Thank you.

Q37 **The Chairman:** We are near the end. I would like to bring together two questions, with Lord Hunt's agreement, on generation IV and Euratom. When we last looked at this area in 2011 we very much favoured a more active role for the United Kingdom in the Generation IV International Forum. We thought that if we were going to be, as you have urged us today, a skilled user rather than necessarily an owner, we needed to keep up to speed with emerging technologies for 2030 onwards. We did not think we were likely to do that unless we participated much more fully in the Generation IV International Forum. The answer from government was that our membership of Euratom would see us right. Of course, that is in doubt now, through the Brexit Bill. So what is your strategy for keeping us involved in the development of generation IV or, indeed, other emerging technologies?

Jesse Norman: Let me talk about the Euratom side, which is the political side, and then, if I may, my Lord, I will invite colleagues to comment on the other side. As the Committee will be aware, as a Government, we have taken an extremely proactive forward-leaning stance as regards Euratom. It will be a regrettable necessity, from our point of view, that notification has to be filed at the same time as Article 50. We remain very engaged with European partners in the EU and among nation states on Euratom. We are actively working up alternative arrangements. We are not formally allowed to discuss any of these things because of the Barnier edict, but it is receiving a great deal of thought within government. There are clear routes forward, from our point of view, which would allow us to continue to deal in the same way with the issues of safety, safeguarding and trade, et cetera, that Euratom preserves. I want the Committee to understand that we take this issue extremely seriously and we are devoting significant resources to maintaining and, potentially, even enhancing some of the benefits that we currently achieve from it.

The Chairman: And generation IV technology?

Professor John Loughhead: Some of the innovation programme that BEIS is supporting directly will be as applicable to generation IV technologies as it could be in the nearer term to generation III+. There are one or two items which are specifically looking at elements of potential generation IV and, if we look at the programme underwritten and paid for by the research councils, there are elements of looking at generation IV in those. The issue with generation IV is that it is still at the exploratory stage. There are various pieces of work going on to do tests at component level of certain concepts, but it covers, as I know the Committee is well aware, a very wide range of potential future nuclear reactor concepts. There is no clear line emerging in that. It is very much a matter of keeping ourselves in a position to potentially play a role in the future.

The Chairman: The point we made in 2011, which remains true to this day, is that we do not pay a sub. We are an observer; we do not participate; we are non-active.

Professor John Loughhead: Correct.

The Chairman: That remains so. I am asking whether it is likely to continue to remain so.

Professor John Loughhead: It is maintained under review. To date the decision has been taken that we have been able to get the benefits we think we need through the current arrangement.

The Chairman: I have a suspicion that when we come to bring together our thoughts we will not have deviated from our original conclusion of five years ago that if we are going to take seriously the ability to be a skilled user, recognising the dependence we will have on nuclear energy for heating and much else, we need to be participating in these international clubs, such as generation IV.

Professor John Loughhead: May I respond to that? I take your point, and the point I was trying to make was that generation IV as a potential deployable technology is still some decades away.

The Chairman: We seem to think that we can wait until someone else has done the heavy lifting and then we can come in later and pick it all up.

Professor John Loughhead: I see.

Craig Lucas: I was going to come back on the broader contextual point that we have no intention of reducing our level of ambition to engage internationally. In the world we are in, the key players in the world still want to talk to us and work with us. We will have to find a different way of configuring those relationships.

Jesse Norman: I would say two things. The Committee, of course, is welcome to raise these matters, as with anything else it does, but I hope, when it revisits the findings of its original report of five years ago, it will give the department or its predecessors some credit for the many areas it identified on which substantial progress has been made: development of the long-term strategy; R&D road map; nuclear R&D board funding;

commissioning to the NNL; expertise on legacy—I can go through a whole list of things, probably 15 to 20 areas, in which the Government have specifically and warmly responded to the initiative made by the Committee. We are very grateful for that.

The Committee might also want to spell out why it believes that additional benefit will be generated via membership through a sub because, from a taxpayer standpoint, it is not clear that, in this or some other cases, being part of something which has a time horizon of that length is a superior use of taxpayer money to deploying that elsewhere in the nuclear industry or, indeed, across government. There are plenty of areas where we have, as a nation, pursued a very successful second-entry strategy and plenty of areas in which we have carried the burden for many other players. I will give you a classic example of that: offshore wind. The commercialisation of offshore wind has been very heavily driven by this country, and lots of other countries are now able to go round and buy very large turbines, very large offshore arrays and floating technologies using approaches that have been pioneered in this country. I do not think we can afford or expect to be leading in every area. I think we remain a very powerful and strong nuclear technology player, and we are recognised as such around the world. We continue to invest in that area; we are upping our game with the first nuclear new build for many years and five more in the pipeline. So the level of ambition is undoubtedly there and on a scale that can only support future technology, and that includes generation IV technologies.

The Chairman: We have come to an end. You make a very good point in your conclusion that we have, indeed, much to be proud of. The NIRAB update indeed indicates that the civil nuclear research and development landscape shows a welcome increase in people. We are leading, as you point out, in a number of areas, not least decommissioning and safety. We are world players. I still have my own personal prejudice—and I should not declare it from the Chair—that if we are to have a long-term strategy we need to be seen to be fully involved with the international community, if we are to do what the industrial strategy suggests and put nuclear as one of the 10 pillars on which we are going to increasingly depend.

Thank you very much for a very positive session. There has been a lot here. I quite accept, as you said, that we have much to be proud of—but do not expect us to be totally uncritical.

Jesse Norman: Certainly not; in a spirit of robust scientific provisional inquiry.

The Chairman: We will continue to suggest that there is more to be done.

Jesse Norman: We welcome that.

The Chairman: Thanks to you and your colleagues for joining us today. We are most grateful.