HOUSE OF COMMONS

# Science and Technology Committee

## Oral evidence: Delivering nuclear power, HC 626

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Watch the meeting

Members present: Greg Clark (Chair); Aaron Bell; Dawn Butler; Chris Clarkson; Rebecca Long Bailey; Stephen Metcalfe; Carol Monaghan; Graham Stringer.

Questions 96 - 165

### Witnesses

I: Michelle Catts, Senior Vice-President, Nuclear Programmes, GE Hitachi Nuclear Energy; and Michael Drury, Managing Director of UK Operations, Terrestrial Energy.

II: Dawn James, Vice-President of Nuclear Power, Jacobs; Dr Tim Stone CBE, Chairman, Nuclear Industry Association; and James Richardson, Chief Economist, National Infrastructure Commission.

III: Ivan Baldwin, Business Development Director, Bechtel; and Corhyn Parr, Chair, Nuclear Skills Strategy Group.

# Examination of witnesses

Witnesses: Michelle Catts and Michael Drury.

Q96 **Chair:** The Science and Technology Committee continues its inquiry into new nuclear power.

I am very pleased to welcome our first pair of witnesses. Michelle Catts is the senior vice-president for nuclear programmes at GE Hitachi Nuclear Energy. Ms Catts is joining us virtually from Wilmington, North Carolina, where it is just after 4.30 am, so we are particularly grateful to her for giving up her time and sleep to join us today. In person in the Committee Room, we have Michael Drury, the managing director of UK operations for Terrestrial Energy, a Canada-based advanced nuclear technologies company looking to enter the UK market. Thank you both for appearing.

Michael Drury, the technology that Terrestrial Energy is championing uses molten salt nuclear reactor technology. Will you describe the basics of that to the Committee?

***Michael Drury:*** Thank you for inviting me to discuss advanced nuclear technologies with you.

My background is, first, in automotive volume manufacturing. I then moved through nuclear, from decommissioning and fusion to existing generation, with the advanced gas reactor fleet, and then into small modular reactors and advanced modular reactors.

I worked for the National Nuclear Laboratory on all different reactor types and ended up being sent to the IAEA to represent the UK on advanced nuclear technology. I had a good understanding of all technologies before I settled where I am today.

My experience in molten salts is that I was chair of the molten salt technology platform in the UK, which was looking after developing UK industry in preparation for supporting molten salt reactor technologies. That was the role I had just before I started with Terrestrial Energy. I had a good understanding of all the different types of molten salt reactor.

There is a variety of types of molten salt reactor, for different needs and different end purposes. The reason I chose Terrestrial is that the molten salt reactor it is working on is faster to market. The way in which Terrestrial is developing it will enable a faster deployment because it is using existing technology that has already been proven through an operational reactor.

Fundamentally, the reactor is a molten salt reactor. It has a pool of molten salt, and the fuel that is used for it is less than 5% LEU—low-enriched uranium fuel. That less than 5% LEU is what most reactors use today. The base product for that, in our technology, is a uranium tetrafluoride product. That UF4 material was produced in the UK, at Springfields, for the Magnox fleet of reactors that were operational before

the advanced gas reactors, so there is a lot of experience that shows that, even though this technology is considered a gen IV reactor technology, it is able to draw upon existing and past capabilities and existing and past operational understanding.

Fundamentally, the advantage of a molten salt reactor is efficiency. The efficiency of the reactor is circa 40% to 44% greater than that of conventional nuclear—today's existing nuclear reactors. Another advantage is that it produces heat. It is not just looking at grid application, for electricity—it produces heat at a sufficient high-quality temperature to make it suitable for industrial applications.

The third advantage is that molten salt is a storage medium. They have been using molten salt storage with renewables for over 30 years, so there is good experience of storing energy within salt, which can be utilised for things such as concentrated solar and renewables, and linking to those renewables.

With the molten salt reactor, I believe you can utilise the salt to burn more fission products and, therefore, reduce waste. You can utilise the heat for industry and, therefore, help to decarbonise the hardest-to-abate parts of industry. You get higher temperatures coming out of the reactor, which fundamentally means that you can reduce the cost of that decarbonisation. Effectively, you can make things more cheaply because you do not have to convert heat into electricity and then reconvert it into heat so that it can be used for industry.

Q97 **Chair:** Given those advantages, why has molten salt not been the dominant technology? Why is it not ubiquitous?

***Michael Drury:*** It is a good question. I was not here when they made those decisions. In fact, I was not even born when they made those decisions.

**Chair:** That is a good alibi.

***Michael Drury:*** I do not honestly know the reason. However, at the point in time when the reactors were being developed, there were other reasons why nuclear technology was being developed. Fundamentally, molten salt reactors are not very good at supplying a certain material for other uses. In fact, they tend to use and consume more of that material. More of the fission product that is being developed to produce the heat is utilised, which means that, first, there is less of it available and, secondly, there is ultimately less waste because you have used more of it.

Fundamentally, the reason was that it did not produce the material that was wanted in the past. However, I was not here and do not know. I cannot state categorically what the reason was.

**Chair:** Fair enough.

Q98 **Graham Stringer:** You are saying that originally the nuclear power plant programme was related to making bombs and that you cannot develop plutonium by this process. Is that what you are saying?

***Michael Drury:*** I am saying that the plutonium that was developed in other reactor types was more efficient in how much was developed. In our reactor type, you burn a lot more of the fission products from the fuel. You cannot extract it as easily from the molten salt.

Q99 **Graham Stringer:** But the original choice of reactors was related to nuclear weapons.

***Michael Drury:*** It could have been. I was not here, so I cannot confirm that.

**Chair:** We will take a note to follow that up. It is an interesting question about the origin.

***Michael Drury:*** I think there were other reasons as well, to do with preferred technologies at the time. Again, I cannot fully confirm that.

Q100 **Chair:** Michelle Catts, being senior VP for nuclear programmes at a major global nuclear energy company, you obviously have an international perspective, but I that I am right in saying that before you joined GE Hitachi you worked for the US Nuclear Regulatory Commission. Is that correct?

***Michelle Catts:*** Yes. First, I want to thank the House of Commons Science and Technology Committee for the opportunity to provide this oral evidence today. It is a pity that I cannot be there in person. I am grateful that I can do this virtually and will plan to be there next time in person.

I work for GE. I have been there for about four years. Before that, I was with the Nuclear Regulatory Commission, the regulator for nuclear in the United States. I worked every position, from resident inspector on site every day at a power plant up to policy adviser for the presidentially appointed chairman, so safety is near and dear to my heart in licensing of reactors.

Q101 **Chair:** Excellent. We are very grateful that your expertise is available to us.

We are interested in reactor design approval processes. You have some familiarity with the UK system and, in particular, the US system. You may be familiar with those of other countries as well. Can you give us an introduction to the key tenets of the regulatory design approval process? Obviously, we are talking about types rather than particular locations at this point. Do you have a view on how the UK GDA process compares to others?

***Michelle Catts:*** That is a very good question. GE Hitachi Nuclear is a world-leading provider of advanced reactors, fuel and nuclear services. We received licence No. 1 in the United States for our first reactor, at the

Vallecitos site. We were part of the first reactor build in Canada. We built the first generation IV reactor, the ABWR, on time and on budget. We have 67 reactors licensed in 10 countries. We are a global company and understand what it takes to work and to license reactors internationally.

Our small modular reactor, the BWRX-300, which we believe is the next iteration of reactors, is the 10th generation of boiling water reactor, hence the X in the name. The BWRX-300 is a 300 MW electric water-cooled natural circulation reactor with passive safety systems. Basically, it leverages the design and licensing basis of our GEH USNRC-certified ESBWR design. It is an evolution of boiling water reactors, not a revolutionary reactor.

In 2017, we launched the BWRX-300. In 2021, we were selected by Ontario Power Generation, through a very rigorous process, to be the reactor of choice for the Darlington site in Canada. In fact, Ontario Power Generation has just submitted the first licence to construct in North America for a small modular reactor. We are very excited about that.

Our reactor is a dramatic simplification. We are using proven components and proven fuel design. Because of all our experience with licensing reactors, we know what it takes to get a reactor licensed. In the US, Canada and the UK, we work with a lot of international organisations.

As you said, I worked at the NRC as a regulator, so regulations are very near and dear to my heart. Four large-scale reactors have been through the GDA process so far. Only one design, the EPR, has progressed to a site licence application, for Hinkley Point C, and is being built today. No SMRs have gone through GDA so far.

We have contacted BEIS with our intent to enter the GDA process. We believe that GDA is an important step in the UK licensing process. It allows licensing to be progressed without an identified site, but obviously site licensing is a key component.

Nuclear in the UK has a great record of safety performance, but we think the current system could work more efficiently and take more advantage of international collaboration on GDA to help the Government deliver on the ambition of 24 GWe, without compromising current safety standards. We understand the need for sovereignty for each individual Government but, to get to those 24 GWe, 80 BWRX-300s would need to go into operation by 2050. That is a lot of reactors.

Q102 **Chair:** May I probe a little on that? For any new reactor type, a GDA process—in other words, an assessment of the safety and dependability of the technology—is crucial. We call it generic design assessment because it is not site-specific.

My question is: how generic is the generic design assessment internationally? Are the processes in the US, the UK, France and other countries much the same, or do they diverge?

***Michelle Catts:*** The process in each country is very different. The United States has a very prescriptive approach to regulation. Canada is more goal-based. The UK is more goal-based as well.

The GDA process is unique to the UK. However, there are other pre-licensing activities in other countries. For example, we are wrapping up the vendor design review process in Canada. We go through a number of focus areas, it takes a number of years and, basically, it shows there are no fundamental barriers to licensing your reactor in Canada.

We have nearly completed that. I would love to see the results of the vendor design review in Canada be able to be used for the GDA, versus starting from scratch, which is another couple of years' process to get through the GDA when we already have a pre-application process approved through Canada. I know a lot of the regulators are collaborating on these things, but I would love to see a lot more collaboration between the regulators in Canada and the ONR.

Q103 **Chair:** Is there any reason why there should be such different approaches to design assessment by different countries, given that the technology does not vary by country? What are the reasons for such differences? Ought there to be?

***Michelle Catts:*** That is a good question. I have heard it said that a neutron is a neutron, whether you are in the United States, Canada or England. The regulatory bodies just develop in their own way. A lot of countries have the IAEA as their international standard, but some countries have diverged from that.

We believe strongly that mature regulators like the ONR, the NRC and the CNSC can work together and collaborate to show that a reactor is safe, especially if it has a standard design, which is what we are doing with our reactor. You have a standard design that you are taking from the US to Canada to the UK. From my perspective, if a reactor design is approved in one country by a mature nuclear regulator, that reactor design should be able to be taken to another country, where the regulator only reviews the deltas—the changes or site-specific things. For instance, only about 30% of an application is site-specific; 70% is standard, if you have a standard design.

Q104 **Chair:** In the case of the UK and the ONR—the Office for Nuclear Regulation—is it your assessment that the GDA process that is required here is broadly right or is it over-elaborate? How would you characterise it, compared with other international regimes with which you are familiar?

***Michelle Catts:*** I believe that the GDA is a very good process if something has not been evaluated somewhere else already. If you have a new reactor design that is revolutionary, is something very different and has not been evaluated by another country, the GDA process is a good process, especially with the three new steps. However, if a reactor has already been approved in another country, it would make more sense for

the regulators to be able to work together to use what has already been approved in another country, to speed up the process for getting to site licensing.

**Chair:** Understood.

Q105 **Aaron Bell:** Ms Catts, Hitachi went through the GDA process in the UK for its advanced boiling water reactor and subsequently withdrew from the market. Was that related more to the site licensing or to the experience of the GDA process? Can you give us a high-level view of why Hitachi withdrew from the UK?

***Michelle Catts:*** We know that the ABWR went through the GDA process, which was completed successfully in December 2017. However, I cannot comment on behalf of Hitachi on the reasons for dropping Horizon. Corporate Hitachi is different from GE Hitachi, so I cannot comment on its reasons.

What I can say is that the ABWR design has been built relatively on time and on budget in other countries. It has gone through the GDA process, which was a really good starting basis for the UK Government to be familiar with boiling water reactors.

I also believe that the Wylfa site is a very good UK site for nuclear deployment. It could be ideal for a fleet of small modular reactors. They have simpler construction and shorter construction times. They cost less. With a modular approach, there is a lot less capital outlay. I definitely see some benefit in the groundwork that they laid.

Q106 **Aaron Bell:** Hitachi spent £2 billion-plus on the project and then pulled out. You say that these ABWRs have been built elsewhere. When were they completed? Are they operational now?

***Michelle Catts:*** Yes, in Japan. I can provide you with a follow-up in writing.

Q107 **Aaron Bell:** At the point where you went through the GDA, were they already operational elsewhere, even though the process still took such a long time? Were they not operational elsewhere at the point when Hitachi was going through the GDA process in the UK?

***Michelle Catts:*** I do not have the timeframe for that, but I can find out and provide the information in writing.

Q108 **Aaron Bell:** Thank you.

Following on from what the Chair said, I am interested in whether, as you suggested, the process is too long in a situation where the design has already been proven elsewhere. You have said that you think our process is very sensible for revolutionary products, but not otherwise.

Mr Drury, I put the same question to you, looking particularly at the future technology that you are interested in. How do you think the generic design assessment process could be improved in the UK?

***Michael Drury:*** The process that has already been applied was a four-step process. It is now moving to a three-step process, with the option of doing steps 1 and 2 first, before you commit to doing step 3. That is a really positive move because it allows the vendors and technology developers to move their product along and then enable further investment with their financiers.

However, in order to get to the GDA and to go through that, you need Secretary of State approval for access to the regulator. The challenge is if we have already been through a vendor design review. We are at stage 2 of a vendor design review. We are further through the regulatory process than any other SMR and AMR in Canada. We are at the point where our report has been reviewed and is due to have the conclusions from the regulator in Canada by, hopefully, the end of this year.

If I were to have the opportunity to change the GDA process, I would like to enable pre-engagement prior to the GDA. The reason is that in the AMR competition that was run in the UK we had such pre-engagement. Lots of vendors were able to talk to the regulator to get an understanding of the size and scale of the regulatory process that we would have to go through for our technology. They were then able to assess that for step 1 and step 2. That helped to de-risk the programmes as we went forward.

Under the same approach, other vendors were also given that opportunity, but pre-engagement is not a firm part of the process. We would request that new vendors that have technologies that have been through a regulatory process enable the ONR to get up to speed with what the other regulators have already looked at so that it has a chance to review the technology and to see the basic layout and set-up, which will enable a faster regulatory process for the GDA. Fundamentally, step 1 is about developing your plan for step 2, to go through the detailed design. In the same way as VDR, it is about finding out whether there are fundamental barriers to your technology.

Q109 **Aaron Bell:** You mentioned that entry to the GDA is controlled by BEIS. Is there an overall capacity problem within the GDA? Obviously, people are competing with one another here. Do we simply need a bit more capacity in the process in order to have multiple technologies evaluated at the same time?

***Michael Drury:*** Yes. I agree that there is a capacity constraint issue. The worry we have as a technology vendor and developer is that the capacity is simply not available. That is not just capacity in the ONR, but capacity in the UK supply chain to address going through the GDA. A lot of the stuff that the ONR does utilises the UK supply chain to help it to go through the technical details. There are only certain technical experts in the world and they go to the same people, so that is within the supply chain.

All the vendors that have gone through the GDA recently or historically have used the UK supply chain to go through the technology. I am

referring to knowledge and experience of things like R5 and R6 codes, which are unique to the UK, to help to transfer knowledge from RCC-M, for mechanical codes for the EPR design, and RCC-E, for electrical codes for design of the EPR, to a UK regulatory environment, and being able to articulate those in a manner that is suitable for a UK regulator. Capacity constraint is a challenge on both sides—for the regulator and for those going through the GDA.

Q110 **Aaron Bell:** My final question follows the questions that the Chair asked Ms Catts and is about what we can learn from international comparisons. It seems to me that you have been saying that we should probably look at whether we can passport some of the knowledge that has been accrued elsewhere. I do not know whether you are familiar with the World Nuclear Association's working group on co-operation in reactor design, evaluation and licensing—the CORDEL group on international standardisation. Is that something you would support as a way forward?

***Michael Drury:*** Yes, I would welcome that international collaboration. It would help with international licensing, in a similar way to the aviation industry back in the day.

However, we should not use that as a delay to rolling out technologies. I think it probably needs to be done in parallel. There is a lot of learning that can be done. For example, Terrestrial Energy went through the USNRC, which is the regulator in the US, and the Canadian CNSC for a specific topic area postulated initiating events. We looked at a very specific topic, what that regulatory change and difference would be and how you would have a joint review of that. The advantage is that at the end of it we had a joint review, which was great. Positive outcomes came from it.

However, going through that process takes longer. If you are trying to do that now and are forcing international collaboration to do it, it may take longer in the first instance. In the long run, especially when you are looking at fleet deployment of SMRs and AMRs, it could be a major advantage and something that should be considered.

Q111 **Carol Monaghan:** Mr Drury, can you tell us something about the challenges around becoming a site licensee?

***Michael Drury:*** A technology developer like us needs to look at sites and how we deploy our technology on a site. If we want to look at site licence applications, typically we will go through a generic design assessment to help to get confidence that our technology is suitable for a site licence application, so that there are no fundamental barriers to our technology.

In doing that assessment, when you look for a site licence application, you need to have an operator on board. In the UK, there is a challenge with having an operator. There is one operator in the UK at the moment, so the challenge is: can you develop that operational capability? Can you bring in an operational capability? How do you get that operational

capability for a site licence application? How do you put a site licence application in if you do not have a site confirmed for your technology?

There is a big challenge on investability of a project. You might know that the economics of your design are brilliant and that you can get a really good economic argument for your technology, which will be highly palatable because it has low cost of electricity, low cost of heat, is good for industry and so on. However, you still need an operator to run it. To get a site licence, the main challenge is: who is the operator going to be and where are you going to apply that licence capability?

In addition, for new technologies—any reactors that are new—you will have to make sure that the operational capability is developed. What I mean by that is training for operators—simulators for new reactors. Nobody has built the SMRs or AMRs yet. We need to develop the training plans. That training takes time. It can take up to 10 years to develop operational capability. We are looking at people who are in school today being the future operators, so there is skills development that would need to be done for operational capability. That moves into the site licence challenge: how do you make sure you have the licensing team available to go through a site licence application?

Q112 **Carol Monaghan:** Given what you have said, do you envisage that there will be much diversity in the operators?

***Michael Drury:*** I believe that if you want to have a competitive marketplace you need to have diversity of operators. At the moment, we do not have diversity of operators. I believe there is a challenge to standing up an operational capability, and a huge cost burden in doing so. The challenge is: how do we help new operators to come into the market and stand up a capability when there is not a clear line of sight to reactors and operating size and scale of projects? We know it is 24 GW, but why will an operator come and invest if there is not a clear project that it can invest in? It is hard to get that operator capability ready.

Q113 **Carol Monaghan:** Ms Catts, do you have anything to add? I saw you nodding to some of that. Was the experience of Hitachi similar?

***Michelle Catts:*** I have a couple of points. To go back to the question on ABWRs and whether they are operating in other countries, the answer is yes. The first ABWR was operational in 1996 in Japan. That was followed by one in 1997 and reactors in 2005, 2006 and 2011. Those reactors were operating in Japan before ABWR went through the GDA process in the UK.

From our perspective as a vendor, site licensing is very important. We understand that the Government are working on a new national policy statement that will reflect a changing nuclear technology landscape—for instance, tackling new site licensing for small modular reactors. There are ways in which you can do it, either by authorising more nuclear sites or by approving unused brownfield sites for SMRs without special

categorisation. The Government can look to release nuclear sites as a matter of urgency—for example, by developing SMRs under the Nuclear Decommissioning Authority's stewardship. That can be done in two ways—through negotiations with current nuclear site owners or by the NDA obtaining appropriate sites for deployment. We think Great British Nuclear could undertake a rapid study of potential SMR sites in England and Wales to help to progress the availability of sites.

The other thing I was thinking about is what would make it attractive for operators to come to the UK, because having more than one operator is really important for diversity.

No. 1: a clear Government policy to develop nuclear, which exists today with the British energy security strategy ambition, the 24 GW. The Government backing was funding programmes through the nuclear industry that are being progressed to help to enable new nuclear projects such as the future nuclear enabling fund.

It is very important for operators that there is a stable regulatory and planning regime, which, as we have discussed, could work more efficiently and take more advantage of international collaborations for GDA.

Great British Nuclear is a vehicle to help to deliver new nuclear in the UK by providing milestones and indication of projects, to make sure everything is on track.

On available sites, with low-cost financing projects and a number of different ways, the UK could really take some additional actions to get additional operators here.

Q114 **Carol Monaghan:** In May, the then Prime Minister, Boris Johnson, talked about building a new nuclear power station every year. Given what you have just said about the planning statement, is that realistic?

***Michelle Catts:*** That is a good question. I don't think so, because obviously you need the infrastructure in place. I guess to get to that 24 GW you would need 80 BWRX-300s by 2050. That is building quite a few reactors in a very short time, and I do not think we can get there without very much streamlining the regulatory process, making sure there is adequate funding, making sure projects are on track. There are some changes that would need to be made to be able to reach that goal.

Q115 **Chris Clarkson:** I want to pick up on that theme and talk about some of the other challenges. You drilled into some of them, but what are the main challenges in using the UK's planning and regulatory process for new nuclear? Specifically, are there any lessons that we can learn from the approach in other countries?

***Michael Drury:*** On regulatory engagement, in the US our experience has been that we have been able to talk to the regulator and go through different elements of our project, different elements of our technology,

and in a sense have White Papers that are developed for those specific topic areas, and then get to a point where we can understand if there are any fundamental barriers to that topic area.

In Canada—it is a similar approach—we have had 19 different areas that we have had to go through and assess and, again, look at fundamental barriers.

The key point is the opportunity for that pre-engagement—the ability to test our technology against the regulatory scrutiny and, equally, understand what the regulator needs and wants. We have already done the engineering. Before we go into the discussions with the regulator, we have to have a good understanding of the technology that has been developed, and how that technology applies to the regulatory regime.

If we don't do that, we end up having to redo a whole load of design. It is really important. The challenge is making sure that your engineering is at a suitable stage prior to regulatory engagement and, equally, then, that you have that pre-engagement before you go through a licence and design certification-type process, in NRC language in the US.

In the UK, again, we need to have that pre-engagement. There is the first challenge: how do we get that pre-engagement?

The second challenge is, if you do a GDA: to what end, to what outcome, to what purpose, to what project? If there is not clarity—you are doing it to do your GDA, developing a project, getting your technology approved, and then you do not have confirmation of doing it for that specific site and that specific project—you may end up spending a lot of money and not actually having a project to get your money back, eventually. It is really important for a regulatory regime that we have an end in mind—an end goal that we are trying to get to, and not just regulatory scrutiny of technology.

On planning, it is a four-year development consent order process in the UK. There is the ability to speed up that planning process. There is experience in the UK of doing major infrastructure programmes in a faster manner. If we are truly looking at deploying 80 reactors by 2050, in Michelle's view, that is going to be a major challenge.

How do we speed up that development consent order process? How do we put in place the changes that allow, if you have developed a reactor for one site and everything is consistent bar maybe environmental impact assessments, because it is a slightly different area, or it is slightly different on seismic because the area's ground condition is different, all those things to transfer across? How can we learn from our own development consent orders and put them into the next of the fleet? The faster we can do that, the faster we will be able to get to that 2050 challenge.

Q116 **Chris Clarkson:** That would be the 70:30 split that Ms Catts mentioned,

where 30% of the process is site-specific but 70% of it is effectively transferable knowledge.

***Michael Drury:*** Yes, and that is even within the technology assessment for the development consent order process. There is also the site licensing application side of it, where 70% is within the GDA, so you can then transfer to site licence applications. It depends whether it is development consent order or site licence—but yes.

***Michelle Catts:*** A lot of great points: I can't explain how important pre-licensing engagement is with the nuclear regulators. We do a lot of that with USNRC and with CNSC for a lot of things—for familiarisation about the reactor design, to address any novel features. For instance, in the United States there is a process called the licensing topical report process. We address any key differences between our ESBWR design and the BWRX-300 in licensing topical reports; and that is a pre-licensing process where it is a discrete topic, submitted to the regulator. The regulator can approve it, with a formal approval, and then you can incorporate that licensing topical report into your licence application by reference; so you are getting rid of—retiring—any regulatory uncertainty very early on.

I would like to see something like that in the UK, where you can retire regulatory uncertainty. Changing the design because of regulatory changes from country to country, as was discussed, is very costly. Design has already progressed pretty far by the time it goes through this process. If you need to make major design changes, it can cost millions of dollars and really sink a project. So it is very important to have pre-licensing engagement.

Q117 **Chris Clarkson:** May I ask both of you whether you think there is any advantage to having a streamlined process where licensing and regulation happen coterminously, or simultaneously? Would that improve the time it takes to get this thing off the ground?

***Michael Drury:*** From Terrestrial's point of view, I think that, yes, it would help. On your first commercial reactor there is probably a little bit of challenge in doing GDA and site licence applications at the same time, because, fundamentally, if you do a site licence you have to do all the stuff that is done in a generic design assessment. The challenge is still the same: having capacity within the regulator—having access for that pre-engagement. Access is really important, but if we are to try to do things in parallel—so, maybe, the site licence application with development consent order—then yes.

That is what we do anyway. That is how the industry works. However, the ability to do that early on means that you need to have confidence that that project is materially there and that you can agree either a set of contracts for difference, a power purchase agreement or a regulated asset base prior to even initiating those things, because that is what

gives you confidence that you can go through that regulatory scrutiny and spend the money doing it.

It costs a fair amount of money—£32 million, roughly—to enter into GDA and go through it, so it is a challenge to put that money aside for a project that you have not yet got a commitment to deliver.

***Michelle Catts:*** I second all that. Obviously, we would like to see the site licensing process, environmental reports and any evaluation move in parallel, versus having to complete one and then move through the other processes.

I would like to see the GDA streamlined, being able to take into account evaluations from other international regulators. As was discussed, it is very important that you have the contract plan in place—contracts for difference, regulated asset base or a similar form of power purchase agreement—so you can move the project along and make sure it continues through to commercial operation.

Q118 **Graham Stringer:** If I may summarise your previous answers, I think neither of you is a fan of having only one operator in this country; you believe in multiple operators. Isn't one of the arguments for sticking with EDF, or one operator, the fact that it will be quicker to get to 24 GW than it would be if we moved to multiple operators?

***Michael Drury:*** It is an interesting concept, because when I was working at the National Nuclear Laboratory it was things like that that I was specifically looking at.

There is an argument that you could streamline it by bringing it back into central Government control, to have one operator. However, if you are going to have a competitive marketplace in the future, what does that operator do? How does it transfer its knowledge and experience outside and export that capability beyond the UK's shores?

If we are looking at getting to 24 GW, we could take the operational capability from the advanced gas reactor fleet that is coming offline from 2024. By 2030 they will all be offline, and, by 2035, Sizewell B, unless it has an extension. The operator capability is within those reactors, and the reactors have good, high-temperature reactor experience that can be transferred across to the operation of new technologies.

Great. So how do you get quickly to 24 GW? If you put the things in place that enable those operators to be trained and developed in advance for new reactors, it doesn't really matter if they are working for a centralised operator or if you are facilitating operators for a diverse operational market. Lots of operators come in, and as long as they are utilising existing knowledge and experience, you should still be able to use that knowledge and capability, and to transfer that knowledge and experience into new operators to have a diverse operator portfolio, not just one.

***Michelle Catts:*** Having seen, after working at the Nuclear Regulatory Commission, a number of different operators and how they operate around the United States, I believe it is really important to have a diverse group of operators. They share operating experience through, for instance, in the United States, the INPO operating experience database. So everybody is working towards best practice, and you don't get that groupthink. You get the collaboration of all these different operators. Some are better at outages. Some are better at different things. You get that collaborative view, and they share this information. It actually makes for better operation of the power plants.

From my perspective, they run longer and there are fewer issues. It is that sharing of information, without people getting into a groupthink mentality. I see great advantages in having more than one operator. I do not think that you would necessarily get anywhere faster with just one operator.

Q119 **Graham Stringer:** How does this country make itself more attractive to operators? Are our safety regulations in line with those of other countries, or are they more onerous?

***Michelle Catts:*** I would say they are different. It is not that they are more onerous, but every country has little nuances, things that are different or that they find to be more important.

I would like to see countries follow more the IAEA approach so there is a standard approach to regulation, to what is required. It is very hard for an operator to come in when regulation is different from one country to the next. I do not see a harmonisation of all regulatory standards. That is probably a grand plan that might be down the road, but a regulator accepting something from a different regulator without adding additional requirements would really help to attract operators to the UK.

***Michael Drury:*** To make the UK attractive there are key things that would help: UK taxonomy and making sure that nuclear is within that UK taxonomy. Green bonds would help.

Q120 **Chair:** Can you explain the taxonomy?

***Michael Drury:*** The taxonomy produced in Europe identified that small modular reactors and advanced modular reactors would be considered to be part of the green position taken forward for clean energy, effectively—so the green taxonomy, but in the European Union.

I think the UK should be looking at that green taxonomy and looking at the potential for green bonds that would support it, but also the availability of sites and clarity of work with those sites. The NPS talks about the sites, and NPS(EN-6) identifies some sites, but if we are looking at 80 reactors that is more than the sites that are in there; so having clarity on how you can get to those sites, and those site discussions, is really important.

The one I have mentioned all the way through is access to the regulator. From a safety point of view, on "more onerous", I do not think it is more or less onerous than the ones we have been through with NRC or CNSC. In fact, CNSC follows an ALARA approach. In the UK we follow an ALARP approach. They are very similar ways of doing regulatory scrutiny, but a slightly different context for how you phrase your claims arguments and evidence that needs to be produced.

The process we have with GDA is about right, but we need to find ways to be able to go through that process and take advantage of what we have learned so far, and how we can support that. How is the ONR going to be funded to be able to support that transfer of knowledge from one regulator to another?

Q121 **Graham Stringer:** There is a major war taking place in Europe, where attacks on nuclear power stations have been one of the tactics used. Has that altered the investment scenario for nuclear power elsewhere in Europe?

***Michael Drury:*** At the moment, our three market entry areas are the US, Canada and the UK, so our focus has been on those. However, we have had a high level of interest in providing our technology for other countries as well, both within Europe and outside Europe.

Has the attack on nuclear caused us concern? Of course. We have to look at safety from that perspective, but our type of technology, molten salt reactor, is inherently safe. It is a passive system, so that helps. With non-proliferation problems, our type of reactor helps as well, significantly.

The attacks on nuclear, in a sense, are causing a security of energy supply problem, and not just in the UK, so that supports developing any technology that can provide power.

***Michelle Catts:*** I agree that Ukraine, if nothing else, has really highlighted the need for energy independence for many countries—not being reliant on another country for your energy, but also for security.

Reactors are designed for security. I used to inspect these things—obviously I can't provide any details—but they are designed for security, and these new reactor designs are inherently safe. With the BWRX-300 passive safety systems, we get security-by-design features.

These reactors can be put in areas closer to populations because the emergency planning zone is a lot smaller. It is really more around the site back within a 10-mile radius.

A lot of design is factored into these new reactors, and Ukraine has really shown the need for energy independence.

Q122 **Graham Stringer:** The Government have indicated that they might reassess the investment in Sizewell C. Has that changed the perception of the United Kingdom as a good place to invest in nuclear?

***Michael Drury:*** Yes. That is a challenge for any nuclear developer looking at the UK because, fundamentally, you are questioning a project that is already going through. If we were to develop in the UK, what is to say that a project we were starting to go through would not have the same challenge as we get near to agreement, or having just gone through agreement?

That is a real challenge and it does knock investor confidence in the market. It is really important that we understand the technology that we are looking to deploy, and whether that technology is going to help with security of supply, getting the right low cost of electricity, making sure you are the most efficient you can be, and ensuring that you can use it for decarbonisation.

All those things need to be done early, so that you do not come into that re-review, re-scrutiny or reassessment at a very late stage in a project development plan.

***Michelle Catts:*** From our perspective, predictability in the process due to commercial operations is very important. People want to see that a process is in place and that people are following it on time and on budget, and that it is predictable. It is very hard for someone to come in later and wonder if the project is going to continue, based on an example like that.

From our perspective, we are focused on small modular reactors; we believe that is the future for reducing risk and cost. Big reactors are expensive, so we understand you need to reduce the cost of concrete, steel and excavation, which is why we have done that. Like I said, predictability all the way through the licensing, construction and operation process is very important for any vendor or operator.

**Chair:** I thank our two witnesses who kicked off this morning's session—Michael Drury, for coming in person, and Michelle Catts for joining us from the United States. I think it is just after 5.20 am, so you deserve an early breakfast.

## Examination of witnesses

Witnesses: Dawn James, Dr Stone and James Richardson.

Q123 **Chair:** I will introduce our next panel of witnesses as they take their seats. James Richardson is the chief economist at the National Infrastructure Commission, whose role oversees infrastructure in the UK. Mr Richardson's career before that was substantially in Her Majesty's Treasury, where he worked on public spending, significantly, which is obviously an important topic behind our questions today.

I am delighted to welcome to the table Dawn James, who is the vice-president for nuclear power at Jacobs, the company that provides engineering, technical and professional construction services to the

nuclear industry.

Joining us remotely we have Dr Tim Stone, who is the chair of the Nuclear Industry Association. We do not seem to have Dr Stone's image, but I am told that he can hear us, so we will proceed on that basis.

James Richardson, one of the things that stopped some of the big nuclear developments in their tracks, including Hitachi Wylfa, was the lack of a dependable financial system—financeable investment—given UK policy at the time. Since then, the Government have embarked on a review and accepted that a regulatory asset base model might be appropriate. Would you describe the advantage of that and why it might make a difference?

***James Richardson:*** It is important to say that the thing that always stops nuclear in its tracks is value for money and the willingness of people to take on the risks involved, which are very substantial. I am talking about financial risks here.

We know that most nuclear projects overspend and come in late. The RAB model shifts those risks off the developer on to a combination of the Government and the consumer. It does not make the risks go away. It does not make it more likely that the project will be delivered on time, because consumers cannot improve project management, and the track record of Governments on delivering large, complex projects is not better than that of the private sector but it shifts where those risks sit. It is easier to find a developer, because they are not being asked to take on that risk. Government and consumers are being asked to take on that risk.

It also shifts some of the financing. This is an important point that the Committee should take into account. It basically asks consumers to lend money to the project at zero interest. That is a cost to consumers, but that cost does not appear in any of the maths when you look at the cost of a project under the RAB. You are not saying, "The consumers could put their money in the bank or the stock market and get a return on it."

So that cost disappears from the maths, but it is a real cost, none the less, and it is perfectly possible to calculate what it is and re-establish it. We did a note that explains how you would compare a contract for difference model, like the one we have with Hinkley, with a RAB model, on a fair basis.

The RAB shifts costs around and accounts for them differently. Some of those costs appear to disappear. For some of them, the risk costs are accounted for differently. So when you say to EDF, "We want you to sign a contract for difference for Hinkley"—you will obviously know all about this—they are taking on the risk that it is late. The consumer is not paying more because Hinkley has been delayed. They know that is likely to happen, so of course they price it in. That is why it is such a high price in the first place because they knew these things were going to happen.

With the RAB model, those costs arise over time, so the price you strike at the beginning is not the price that consumers and taxpayers pay at the end. Again, you are accounting for it differently. It is not that one method is inherently better than the other, but it is important to understand that those prices are not comparable. The RAB price is mathematically going to be lower than the equivalent CfD price, but that doesn't mean that consumers and taxpayers are getting a better deal. They only get a better deal if the project is delivered more efficiently, and nothing in the RAB model inherently improves the project management of these large, complex projects.

Q124 **Chair:** In terms of the transparency, for better or worse, the strike price in a contract for difference is what it says on the tin. That is what is going to be paid for the power, and the risk is with the developer. Would you accept that there is a danger in having a headline lower strike price that doesn't crystallise the financial value of that risk, that it looks, and may even be parlayed as, cheaper, but that that is because the big financial cost—the insurance cost, the risk cost—is not specified? Do you regard that as a problem in comparing different models?

***James Richardson:*** I think it is a risk. You can do a like-for-like comparison, and we have set out the maths for how that would be done. You would need all the details, of course, of the precise RAB, to put a figure on it. We have set out the mechanics of how you would calculate that, but there is a risk that, yes, a lower number gets out in the public domain and the Government start using it, and it is not comparable.

It looks like the RAB is going ahead, and that is not a bad thing, but it will be important for the Government to be transparent on a comparable basis. Of course, transparency on that is something that organisations like ours will hopefully help with, but the Government should do it and are capable of doing it.

Q125 **Chair:** The Treasury, over quite a long period, was resistant and in my experience rather hostile to the RAB model for nuclear. What has changed to make it overturn what has been described as Treasury orthodoxy in other contexts recently?

***James Richardson:*** The Treasury will always be wary about the taxpayer taking on risk, because they know these risks crystallise and they are left holding the problem. You would have to ask the Treasury whether they have changed their mind or whether, simply, the Government as a whole have changed their mind. The Treasury does not win every argument on Government orthodoxy, but I think the Treasury worries about the risk that the Government hold, and the RAB model puts a risk on to the Government. The Treasury has a long memory of the risks of nuclear that have sat on the Government's balance sheet from the old days of the CEGB.

Q126 **Chair:** It is appropriate for it to worry about it, isn't it?

***James Richardson:*** Indeed. It's the Treasury's job to do that.

Q127 **Chair:** Not all orthodoxies are inappropriate, as we have come to discover.

Dr Stone is visible to us now. Thank you for joining us, Dr Stone. Perhaps before we go into more detail in this session, I know you have some expertise on the UK regulatory approach to foreign licences for overseas technology being deployed here. I think you heard the previous panel. Would you briefly add your view on that?

***Dr Stone:*** I thank the Committee enormously for giving me the opportunity to give evidence this morning and apologise for not being able to be there in person.

The regulator in the UK, following the review we did at the end of the noughties, has changed quite a lot. They now describe themselves as an enabling regulator. At a conference we organised with international investors at the end of March, the chief inspector said very openly and clearly that the ONR is now very happy to take a position on GDA going forward where they take a foreign licence as what they would call a technical support organisation input. To put it in plain English, they take the other regulator's homework and remark it, and it would be expected to be very much faster.

I am happy to say that kind of collaboration is being talked about a great deal in international regulatory circles. The current regulator in the UK is having conversations with the Canadian and US regulators about how they can do that. That is exactly the same approach as we took with Abu Dhabi in the first place. We took the original licence from Korea as a starting point and built a regulator to polish the wider regulatory impacts, but the UK is now in a position where, with our enabling regulator, we will look at foreign licences and not start ab initio.

Q128 **Chair:** You describe the regulator as an enabling regulator, or that its demeanour is intended to be enabling. Is that an aspiration? Is that a word, or have you seen anything in the practice that has changed?

***Dr Stone:*** It is a very balanced regulator. It is not a regulator that sits there and just says, "The answer is no. Go away." It is much more engaged. It is still completely independent; it is very sovereign and thorough, but it takes the view that as a regulator it has a duty to take its responsibilities on a balanced basis in terms of the consequences of the way it imposes its regulatory duties.

For example, you have seen that in Sellafield where there has been a significant improvement in some of the projects up there where the regulator has been part of a wider conversation, asking questions like, "Is there a better way to do this? Can we do this more effectively?" So, yes, it is a good catchphrase, but it is very much a practical, balanced regulator.

An issue for all regulators, whether they be safety or economic, is to balance the way they implement their duties in law and statute with the

consequences and to think about whether there are different ways to adapt our regulation to ensure that the outcome overall is in the better interests of civil society.

Q129 **Chair:** Mr Richardson, on the National Infrastructure Commission, is a new national nuclear planning statement needed to help to achieve the Government's now stated target of 24 GW of nuclear power?

***James Richardson:*** I think we need an entirely new suite of national policy statements in the energy sector. We had drafts of most of these a year ago, and they seem to have disappeared. Hopefully, they will re-emerge, because there is a lot of—

Q130 **Chair:** Why do you think they disappeared?

***James Richardson:*** I do not really know why they have gone quiet. They went to the BEIS Select Committee, which held hearings on all the processes they were undertaking. It may simply be that Government decision making has rather slowed down. It will hopefully reappear, but there is a lot of infrastructure in the energy sector that needs to be accelerated. That is not just nuclear by any means; there are far bigger amounts of investment in grids, renewables and things like hydrogen. All of that needs a new national policy statement because, naturally, these things go out of date.

Q131 **Chair:** When is it needed by?

***James Richardson:*** We have said it would be sensible to do these every five years. The current one is slightly over 10 years old, so we need to get on with bringing them forward. You see this across a lot of planning for infrastructure. The regime around national policy statements and so on has been very successful at enabling planning, but as these documents get older and older the regime is becoming less successful. It is becoming easier to judicially review planning matters because the documents are out of date and things have moved on.

To get these national policy statements out is a real priority and something we have been calling for, and hopefully the new Government can move quickly on that.

Interestingly, there was not a new update on the nuclear statement as part of that suite. The whole of the rest of that suite was put forward in draft nuclear 1, and again you would want a new updated statement.

Q132 **Chair:** Why do you think that was? Is it because nuclear is more difficult, or do you think there was some hesitation about including nuclear?

***James Richardson:*** It is probably because nuclear is more difficult. There was a separate process going on. The Government promised there would be one, but it did not appear. You would have to ask the Government whether that is because they are politically cautious about it or because they think it is harder to make the needs case, but it is fair to say that nuclear is always more complicated than the rest of the energy

system because the safety issues are much more substantial and the value-for-money case is much harder to make than for many of the alternatives.

Q133 **Chair:** Dawn James nodded when you referred to nuclear being harder and more complex. Ms James, you work across the nuclear industry. Your company has lots of different organisations there. What is your view of a new national nuclear planning statement? Do you think that is needed?

***Dawn James:*** Yes, I do. I was nodding because I think we over-complicate nuclear; we think it is very complicated.

Jacobs has worked in the nuclear industry for over 60 years. The UK built the world's first nuclear power station, Calder Hall, in 1956. Since then we have had two fleets of reactors, Magnox and AGRs, and now we have Sizewell B. Over that period, we have generated up to 25% of the UK's electricity using nuclear power.

As a nation, we are pioneers. We are a nuclear nation, and we have done this safely and securely, but what we have not had for the past 35 years, until Hinkley, which is now under construction, is anybody constructing nuclear power stations, so we have made it complicated for ourselves. We do not necessarily talk about it enough as being something in which we are extremely well experienced in doing safely.

I understand that the last national policy statement was in 2009 and there was a commitment to revise EN-6 in 2020. That has not happened. What we are talking about now is how we deliver at least 24 GW of nuclear to the grid by 2050, so it is not a case of "if". I like to think we are not making the case; we are saying how we are going to go about doing it and how we will do it effectively.

Q134 **Chair:** Dr Stone was nodding. Let me ask him to express his view on that, and perhaps to say whether this new, slightly mysterious and ambiguous organisation, Great British Nuclear, might have a role.

***Dr Stone:*** Can I add that the evidence internationally is not quite as Mr Richardson says? I am happy to give you detailed evidence in writing separately.

GBN was the result of the recognition, following the Ukraine war, that the UK's energy independence is severely under threat, and has been for some time. I cannot talk about the content of the report submitted to the Prime Minister at the beginning of September, but I was heavily involved in the process over the summer.

The first thing to say is that we need GBN up and running as fast as possible, because it is a systemic look at the nuclear part of our system, and it is only working on a systemic basis that we have performances that match what has happened in Japan, South Korea and—I probably should not say this—in China and Russia, and in France and Sweden.

I mentioned earlier that I was part of the original Team Abu Dhabi. I was regional financial adviser to ENEC. They have built their things pretty much on time and on budget by doing it in a way that Dawn, Jacobs and our nuclear industry know how to do.

The key issue is building fleets. This is exactly what happened with renewables, where we started out with really expensive solar at £440 per megawatt hour. By building a fleet, the cost has come down.

It is the same experience in nuclear globally. If you look at the true history—I would point the Committee to the Energy Technology Institute's report on nuclear cost drivers—it is clear that we can do it.

GBN, if it is implemented in the way the recommendations were submitted to the Prime Minister, will make a transformational difference. From a week in DC a couple of weeks ago, it is quite clear that the international community sees all this as a great place to invest in the UK, but we are competing with North America and Europe, from Estonia through to Romania and the Czech Republic. A huge deal was recently announced between the US and Poland for reactors there. Mark Rutte stood up in the Dutch Parliament over a year ago and said that the Dutch needed SMRs.

We need to approach this on a programmatic basis. I am certain that doing so will produce delivery on time and on cost, and that the cost of doing so will be dramatically reduced.

Without pausing for breath, I would like to say that one of the consequences of a sensible approach, like RAB financing, is that the cost of capital is dramatically reduced. Any percentage increase in the cost of capital over the minimum possible is simply an artificial tax on our energy. We do not need that. We should be financing these things as cheaply as we possibly can, recognising that in big national infrastructure, not just nuclear, the Government own failure. We have to take a view, which is part of what GBN will do, on how to make sure that failure does not happen.

Q135 **Carol Monaghan:** Dr Stone, you referenced solar, which is the most expensive renewable source. There are other, far cheaper renewable sources.

Mr Richardson, can I confirm that the NIC has previously commented that the RAB model has never been used for a complex nuclear project anywhere, not just in the UK?

***James Richardson:*** That is broadly true. There are some things that are not the RAB model but are similar to it in the kind of risk transfer that has been done in the US. Some of the US vertically integrated utilities essentially mean that the risk sits with the taxpayer and the consumers in those cases.

It is certainly true that the UK has not used the RAB model for anything like a nuclear power station. It is used mostly for utilities like the national grid. There is also the Thames Tideway project, which is more similar but does not have the engineering complexities of a nuclear power station.

Q136 **Carol Monaghan:** Why is RAB needed? Surely, for these other projects private investment is brought in as well. Why is RAB a requirement here?

***James Richardson:*** RAB is a requirement because no private company, including EDF, which is about to become a taxpayer-owned company in France, is willing to own the risk of building a nuclear power station.

Q137 **Carol Monaghan:** It is believed that Sizewell C will cost about £30 billion. If the Government take a 20% risk stake, that is £6 billion, which is quite a significant risk. Is this a good risk to take given there are other, cheaper alternatives?

***James Richardson:*** The risk the Government are taking is the risk on the overspend, not the total cost of the project. The median overspend on a project like a PWR at Sizewell C is 40%. On the point I think Dr Stone was trying to make, we have looked at hundreds of these projects internationally.

Q138 **Carol Monaghan:** The cost to the taxpayer, whether it is an overspend or anything else, is the same.

***James Richardson:*** No. The cost is on the overspend because the investment, as it were, will be repaid through bills. If Sizewell did not overspend, it would be a much better investment than if it did, so it is really the risk, but it is still a sizeable sum. There is no argument that the taxpayer and consumer, under the RAB model, would be taking on a very sizeable risk.

Our view is that there is a case for Sizewell C because, if you do not build it, you are basically taking nuclear off the table in the UK, because you have careful and difficult—

Q139 **Chair:** Is the implication that there is a RAB-based case for it?

***James Richardson:*** The RAB is the only show in town, as I understand it, in terms of anyone's willingness to build it.

Q140 **Chair:** It involves an implicit assessment that RAB should be proceeded with.

***James Richardson:*** Yes, but RAB inherently does not make it cheaper; it just shifts the risk and where those costs appear.

The argument for it is not that Sizewell C is low cost, because it clearly is not; it is that it may add system benefits in the ability to manage the energy system as a whole that just about balance out the higher cost of electricity.

You probably do not want to say at this stage, "I definitely don't want that in my energy mix at any point between now and 2050," which is effectively what you would be doing if you stopped the nuclear programme in its tracks with Hinkley.

Equally, you do not want to say, "We're going to ramp up all of this. We know what the energy system will look like in the 2040s," which is the commitment that you are making on nuclear. Sizewell C might come in in the late 2030s, but anything else is the 2040s. Saying that we want to build lots of stuff in the 2040s is a huge gamble given the alternatives and the cost reductions we have seen there.

We think it is sensible to do Sizewell C, but we would not then accelerate or commit to a much larger programme. You might commit to a third one. If you have brought Hinkley in, you will know more at that point, and you will know more about the alternatives. Does the cost of wind keep falling, for example? Are we able to build the national grid to bring power down from places like Scotland where wind is cheap?

Q141 **Stephen Metcalfe:** I want to talk a little bit about the pipeline of projects, or the lack thereof. Mr Richardson, why did the National Infrastructure Commission recommend that the Government allow only one project to go forward by 2025?

***James Richardson:*** It comes down to the terms of the bet that you are making if you commit to a nuclear power station. Basically, you are making a trade-off that says you are going to commit a large sum of money, which ultimately will be paid for by energy consumers or taxpayers, on projections of the long-term cost of the energy system as a whole. You are making a bet on what things will look like in 20 years' time.

That is very uncertain. Even in the time we have been building Hinkley we have seen huge changes in the costs elsewhere in the energy system. You do not want to make those kinds of bets casually; you want to think very carefully about the upside and downside risks.

The downside risk is that you build something that could turn out to be much more expensive than you think, but the alternatives could also turn out to be a great deal cheaper than you think. That is often what has happened. If you look at the value-for-money case for Hinkley, which was the best evidence available at that time, the lowest cost for offshore wind was £80 per megawatt hour. The latest number is £37.

I should emphasise that it is not that people did a bad job; it is just that the world has changed in a relatively short period of time. Therefore, in making those kinds of bets you have to take into account that it could turn out to be a very expensive thing to do.

If you look at the other side of it, what are the upsides? It provides system benefits that might turn out to be more expensive to provide in

other ways. It is not that they cannot be done in other ways, but perhaps those other ways do not turn out to be as cost-effective as you might hope. Therefore, it might bring down the cost of the system a bit; it might add to it by quite a lot, but there is also the point about whether you take an irreversible decision to take nuclear off the table.

Our view was that, if you did not say you would do anything after Hinkley, you would have lost all the investment you have made in creating a supply chain. It would be very difficult to get that back and up and running again in the 2030s.

That is what the terms of the balance look like to us. We thought that, therefore, it did not make sense to make the bet on a big fleet—we still think that—but it also did not make sense to say, "I'm going to stop now." One more allows you to keep that option on the table.

Q142 **Stephen Metcalfe:** We have had quite a lot of evidence that says the Government need to indicate their support for nuclear to make sure there is a pipeline. We have one project; we have another under discussion; and we have some ideas, but nothing more than that. Do we need the Government to take a firmer, clearer stance to get that pipeline and to ensure we do not lose the skills and infrastructure we have built up? Otherwise, presumably the limited number of people who are able to deliver this, as I think we heard in the previous session, will go elsewhere.

***James Richardson:*** Sizewell is a commitment through to the mid-2030s. That is quite a long-term commitment. The Government are not making many commitments through to the mid-2030s. Therefore, you are making a big, long-term commitment by doing Sizewell.

That is part of the case for it, but we have to be very careful about returning to what I think of as the nuclear boom-bust cycle, which we have seen way back from the Magnoxes, the AGRs and Sizewell, where we were promised that for some reason it would be a very cheap technology. The reason now is small. It is worth remembering that not all that long ago the reason why it would be cheaper was that it would be large. We were told that the Magnoxes and the AGRs would be cheap. It is all there.

Then there is a rush of enthusiasm. We set out some very large targets—you see that with all these technologies—and reality slowly sinks in, projects become more difficult and we cut back.

That is not an efficient decision-making process, any more than the Government halfway through the process suddenly saying that they might scrap Sizewell C is an efficient process. It is much more sensible to adopt a steady-as-she-goes approach and say you will take a decision on Sizewell, which is a big decision, and learn some more over that period. In the next Parliament we will know a lot more about the alternatives. We will know whether Hinkley is delivered. Hopefully, it will be delivered in

the next Parliament. Then you can take another decision. It is a much better decision-making process when you are looking at things over these very long periods.

**Chair:** We must have slightly more succinct answers if we are to get through all the interesting questions we have.

Q143 **Stephen Metcalfe:** I will try to keep the questions straightforward. First, to all three of you, what is your reaction to the idea that Sizewell C is under review, or do you believe it is under review? Do you think it has just been misspoken? I can see Tim shaking his head.

Secondly, do we stand any chance whatsoever, as we sit here this morning, of delivering 24 GW of electricity from nuclear by 2050?

***Dawn James:*** My understanding is that it is misreporting. I was really pleased to see what I saw coming out on Friday afternoon and hear the current PM say what he said to *The Sunday Times*. That was fantastic. For offshore and nuclear, it is great news.

On the question of cost, only by having a fleet effect and the programmatic approach Tim has talked about, which gives certainty to the supply chain and the industry, will we have the right skills in the right place at the right time. Defining what technology we are going to deploy when and where is critical to delivering our legal obligation to net zero by 2050 and giving the UK energy independence.

I am sorry, but I disagree about nuclear not delivering cost-effective energy. Look at Hinkley Point B, which came off the bars in August of this year. It has operated for 46 years. Its design life was 30 years. Every single one of the AGRs has gone well beyond its design life and the original financial model done to substantiate the build.

We have lots of different arguments, but my understanding is that this is not a case of whether we are going to do nuclear; it is how we are going to go ahead and do it. For us to be successful, it is absolutely critical to take the benefits of that first of a kind. It is 35 years since we built Sizewell B. I know that because as a teenager I started my career with it. We have not been constructing power stations since then. We have built a huge body of knowledge and capability. What we need is a programme that sets out sequentially what we are going to do so we can transfer those skills, take the learning and drive down the cost of construction.

We should not forget all the delays that have beset HPC outside the control of the project, notwithstanding covid; there have been many others as well. We have a great opportunity to make a difference to the UK to give us energy security alongside renewables and deliver our target of net zero.

Finally, I hope the Committee does not mind my saying that we have an opportunity to make a difference to our population. The jobs we have in the nuclear industry are fantastic—they are long term, well paid and

interesting. We have an opportunity to do something about diversity in the workforce. I hope you do not mind my saying this as a lady.

**Chair:** It is important that you do.

***Dawn James:*** I started as an apprentice a long time ago. I am now in my mid-50s. Only about 16% of our technical and engineering workforce are women. We bring in women but do not keep them. This is a great opportunity to take things in a different direction. I see GBN being at the heart of all these things.

Q144 **Chair:** That is a very important point to make. The Committee is consistently and constantly concerned about this. The nuclear industry, rather dispiritingly, conforms in many ways to the lack of diversity that some other STEM sectors have.

***Dawn James:*** Unfortunately, yes.

***Dr Stone:*** Can I start by agreeing with Mr Richardson on one thing? We need a proper systems plan for the energy system in the UK. At the moment what we have is an approach built on hopes and dreams, and I am afraid that much of what Mr Richardson said about the nuclear industry is on that scale.

To be clear, 18% of our energy comes from electricity. Apart from Sizewell B, the whole of that has to be replaced by 2050 to reach net zero. Then we have to replace the other 82% that comes from fossil. The pace and scale of what is necessary is vast. I profoundly disagree with much of the NIC's analysis. We will send you comprehensive details of why the rest of the nuclear industry and indeed investors around the world do not agree with Mr Richardson's statements about costs and time.

Secondly, I want to be clear that Great British Nuclear is the way forward. Dawn has mentioned some of the aspects. Over the summer we looked very carefully at what is practical and durable based on evidence around the world of what is already happening and what has happened in other countries. You take that in combination with the regulatory asset base, which, as I said earlier, dramatically reduces the cost of capital. In the case of Sizewell C, work done by one of the leading investment banks talked about taking about 30% or 33% off the cost of Hinkley simply by reducing the cost of finance, because 80% or 90% of the cost of Hinkley in the end is finance. We have to get those numbers down.

There is no question but that nuclear is not a silver bullet but a critical part of a balanced energy system around the world. From the point of view of investors, they are now choosing which countries they go to, whether it is the Czech Republic, Poland, the Netherlands or Canada. Indeed, the Australian Parliament is now starting to look at nuclear as well. Around the world it is a critical part of the answer.

I am quite concerned that the Committee understands the hard facts from other countries, such as Abu Dhabi more recently, and looks at the full history of nuclear, not just partial bits and pieces, which is very easy for anti-nuclear groups.

To make one last point, I picked solar to make the point that something that was so expensive in the first place has come down vastly. The same has happened with wind. Wearing my hat as a former member of the board of the European Investment Bank, we worked really hard to enable those costs to come down through a fleet effect. We have not had the fleet effect in nuclear in the UK in the way other countries have. That is why we have not seen any big changes yet. The Government have a fundamental role to make sure that our national energy infrastructure is built, maintained, operated and replaced, and that is where I think Great British Nuclear gets us to. I am more than happy to follow up with details offline.

Q145 **Aaron Bell:** We received in written evidence identification of several key infrastructure challenges in building out the nuclear fleet. I would like to ask the witnesses in the room, in particular, what they think will be our greatest infrastructure challenges.

***James Richardson:*** As I said before, the greatest challenge is always value for money. I will not repeat that, but I would just say to Dr Stone that we have looked at the facts on hundreds of plants that have been built over the years. We are not making this up. All of this is on our website, and I am very happy to send details to the Committee on those schedule overruns—on a full distribution, although of course some get built on time and on budget, but most do not.

Beyond that, you have to connect it to the rest of the grid, but that is a challenge for all the energy system. It is not worse for nuclear; in some ways it is probably a little bit easier because the sites, certainly Sizewell, are closer to the main demand centres than some of the sites for wind. Therefore, it is a challenge, but not a particular one for nuclear.

You then need to be able to balance the whole system. Electricity demand is very variable through the day, the seasons and across years. Nuclear basically produces a flat line. Wind and solar go up and down in ways that are predictable over the long term, but not particularly over the short term. Demand is much higher in winter, particularly if you electrify heating, as we will probably have to, than it is in summer.

You need to find ways of storing power and shifting it over time. That is true whether you have wind and solar and you need to deal with a windless week; it is true whether you have nuclear and you need to deal with the fact that there is more demand in winter and nuclear is still producing the same amount. It is windier in winter, so renewables are a bit more helpful.

It is also true, as we are finding out in France, that a nuclear fleet can go offline and then you need a back-up.

For all these things it is a system requirement. Nuclear might make it a little bit easier for some of these things; it might make it a little bit harder on some other things, but it is not fundamental to nuclear or renewables. We need to sort out those grids and get it built; we need long-term storage and flexibility; we need to build some of the new technologies like hydrogen. For some of it you can use more familiar technologies, but we need to bring forward those things rapidly.

Q146 **Aaron Bell:** We heard in our evidence session a couple of weeks ago about the challenges of cogeneration. Would those be significant infrastructure challenges if we were trying to implement cogeneration of heat at the same time?

***James Richardson:*** You can take heat out of a nuclear power station; it has been done. The heat that comes out of an existing nuclear power station is not particularly high quality because it uses steam. Some of the technologies we heard about today would give you higher heat.

Essentially, you should think of that as just another source of value that a nuclear power station might be able to create. It will probably not change the overall economics. There are other ways of generating heat. If you want high heat you can burn hydrogen. At the moment, most of it is generated by burning natural gas; in the future we will generate it by burning hydrogen. If you want low heat, you can do that with electricity.

It is something that nuclear stations could do, but they have always been able to do it. We have had 70 years of this, but mostly they don't. The economics of it are clearly not so compelling as people have not found a way of doing it up until now, but it would add some value and we should not ignore it. We should probably try to find a way of doing that, but it is not a game changer.

Q147 **Aaron Bell:** Ms James, from your perspective and that of Jacobs, what are the greatest infrastructure challenges that we face?

***Dawn James:*** The greatest infrastructure challenge, if you think about infrastructure in its broadest sense rather than just concrete, roads and things like that, is around skills and making sure we have an understanding of—*[Inaudible]*—going forward.

Most of the conversation in this session seems to be about big gigawatt. What we need to be doing is investing in the future—SMR and AMR technology. Advanced modular reactors could produce a huge amount of heat that can be used solely to generate green hydrogen, so developing those technologies is the challenge we have. The investment by BEIS in the nuclear innovation programme has gone a long way towards doing that, and it is something we need to continue doing.

The challenge is that we take a short-term view. We must not do that if we want to control our electricity. Tim said we are electrifying the country. To do that, we need to change the way in which we think of our energy systems.

On big gigawatt, I think we need one, maybe two, technologies. We have talked about the fleet effect, the first of kind and next of kind to drive down costs and to do these things much quicker, bringing SMRs on to the grid and getting them through the regulatory, licensing and planning process, and developing advanced technologies.

The advantage they bring is that not only can they be deployed in different locations—they can be deployed in communities—but you can create energy hubs that can service community needs. A very good example is the Cumbria area. Cumbria is very comfortable with the nuclear industry and understands it well; it is at the heart of who they are. We think about the potential for the Moorside site right next door to Sellafield to accommodate an energy hub. That can provide energy for the community but also for some big infrastructure, like data centres or even electricity for the Sellafield site to operate.

The challenges are to take a long-term view and to take control of what is happening in our energy system in the UK for the longer term. I have a four-year-old granddaughter. I hope that one legacy I leave behind is that she has secure energy.

Q148 **Aaron Bell:** You mentioned the importance of skills and that long-term view. What role do you think our national research facilities play in that? I am thinking of North West Nuclear Arc and the National Nuclear Laboratory. Some people have raised concerns that we do not have enough testing facilities in the UK. Do we also need to expand our research facilities?

***Dawn James:*** We need to continue to invest and grow it to meet our future needs. Jacobs has the largest independent nuclear laboratory in the UK. For the past 50 years we have been conducting and engaging in trials of major components that sit within the current fleet of power stations to support the safety case. We need to make sure we have the right facilities to meet the needs of that programme going forward.

Q149 **Aaron Bell:** Dr Stone, do you want to comment on either the national research facilities or the infrastructure challenges in general?

***Dr Stone:*** On the infrastructure challenge, Dawn is quite right. What we need to do is use the existing facilities as best we can. The original siting assessment for the gigawatt-scale reactors would put them on existing sites with existing connections. Some little bits of reinforcement would be needed in a few places, but it is a relatively small amount.

When we come to do a siting assessment for small reactors, it is important that we do what Bill Gates's company is doing with one of the big US utilities in Wyoming—re-power coal sites where the facilities are

already there—rather than adding yet more challenge to poor old National Grid's already huge battle to try to connect all the rest of the system.

As I said at the beginning, it still needs a proper systems plan. If I had a dream, it would be that the first thing the government's new chief scientific adviser, succeeding Sir Patrick Vallance, does is to commission and oversee a proper independent, fact-based systems plan for energy in the UK, because we have to replace all of it.

We have a couple of national labs in nuclear, both at Culham and the national nuclear lab, which are very good, but we do not invest in them properly, as Dawn said. If I compare and contrast, the US Government put money into the national labs to get science and engineering out. We almost seem to put science and engineering into our national labs to get money out.

If we are serious about investing in the future of this country and for our grandchildren, we need to treat this as a proper, big national endeavour. This is not about tweaking little projects here and there; it is about a systemic approach and the best solution for the energy economy in the 2050s, because by that point we will be a data-based economy. You can already see big data companies like Microsoft, Google, Apple and so on all looking for nuclear power solutions to ensure they have stable, reliable power for their data centres. There is a lot we can do here.

Finally, one of the future applications in the UK is in big shipping. If you look at the opportunities for the UK, as a country that financed, insured and flagged vessels for donkey's years, with a national nuclear capability to support all that, we need to be backing that—for example, in the way Scandinavian shipping families are, the way investors in Japan are about to do and the way the national labs in the US are.

We need to raise ourselves up and finally recognise that this is about a technological issue, not just simple economics. Economics are part of it, but, to go back to an earlier comment, the existing AGRs and the former Magnox reactors are high-temperature gas reactors. They produce high-quality heat, which you can use for generating efficient hydrogen, but also to help make steel, glass, cement and so on.

Can we raise this above a simple, non-fact-based economic argument to a technical one that balances out the whole thing?

**Aaron Bell:** I am sure the Committee will aim to do that.

Q150 **Dawn Butler:** Dawn, you refer to our future needs and the Government's aims and announcements. Is the nuclear supply chain ready to deliver these aims and needs?

***Dawn James:*** We are delivering what we can see ahead of us in terms of where we are now. I will talk just about nuclear new build and the work going on at Hinkley Point C. If none of you has been to Hinkley

Point C, I suggest you find the opportunity to go to that site. It will give you a view of the complexity and size of these construction projects, which is why you have that very high upfront capital investment on which you get a return over 60 years. On that site you will see 7,000 people working right now, so our supply chain is already working on Hinkley Point C.

Would we be ready tomorrow if we were to say that with SMR we need not worry about any kind of GDA process? We would not be ready then, but we are prepared. We have the skills and knowledge, and we have done it before. What we need is a programme. We need certainty. We need to know where we are going.

We have a challenge, which I think Tim mentioned. Many other countries are moving forward with their programmes. We are providing technical advice to Poland as it initiates its nuclear new build programme. We are seeing other countries, either virgin nuclear states like Poland or other states in central Europe, starting nuclear programmes, so we are seeing a potential draw on skills. That is a challenge we need to overcome, but with certainty and with a plan, yes.

Q151 **Dawn Butler:** Are there any interventions that you think are needed in the short, medium and long term?

***Dawn James:*** We have probably covered most of them. The biggest intervention for me, hopefully this month, will be that commitment to Sizewell C and a firm commitment to move forward at pace. I hope we do not see any delay with the ball being kicked down the road and things just ticking over. What does cost a lot of money is keeping the project waiting to move forward. The commitment to Sizewell C to move forward at pace is an intervention that would make the biggest difference right now.

I have talked about establishing GBN and giving it autonomy and authority to deliver the programme of 24 GW by 2050.

On the consenting and planning process, that intervention absolutely has to come from Government thinking and reimagining how we are going to do things so we can do things quicker.

Q152 **Chair:** I have a final brief question to Dr Stone, with hopefully a brief answer.

On the supply chain, does the Nuclear Industry Association, which you chair, plan to update its supply chain capability report in light of the developments we have been discussing in new nuclear?

**Dr Stone:** That is on our list of things to do in the very short term. We will co-ordinate that very closely with Great British Nuclear, because the response to a programmatic approach, which is what I hope GBN will be pushing for both large and small reactors, is really about how we grow the UK supply chain as fast as we possibly can, along with the supply

chain for people in the UK, which, as Dawn said earlier, is one of the other critical issues here.

There is already a body of evidence, which we are happy to provide to you. There is a lot of work that will follow on from GBN, but, frankly, until we have that in place—I think it will transform the way we see nuclear built in the UK—we do not want to jump the gun. The evidence is already there and is ready to be reported. We would be very happy to provide that separately.

**Chair:** I thank our three witnesses on this panel: Dr Stone, James Richardson and Dawn James.

## Examination of witnesses

Witnesses: Ivan Baldwin, Dawn James and Corhyn Parr.

Q153 **Chair:** We are now going to move on to a discussion on skills. Since Ms James has raised the subject of skills, with her permission I have asked her to continue to give us her time in this final panel so that we can ask her to continue her very valuable insights.

Joining Dawn James at the table, I welcome Ivan Baldwin, who is business development director at Bechtel. He has long and substantial experience in providing services to the nuclear industry.

We will shortly be joined online by Corhyn Parr, the chair of the Nuclear Skills Strategy Group.

Dawn James, you have raised the subject of skills and its importance, and you have been very clear about having a long-term pipeline of nuclear projects to allow careers, such as your own, in the nuclear industry. As a result of the stop-start process, to what extent is there a shortage of nuclear skills in the UK at the moment?

***Dawn James:*** There is not a shortage in terms of our need to deliver what we have here and now, but, if we look at the workforce we currently employ—when she joins us Corhyn will probably have more specific statistics—a large proportion are at the back end of their careers, in their 50s, a bit like myself.

What we do have, and have brought in in recent years because of programmes moving forward—Hinkley Point C and Sizewell C—is quite a young demographic. We have an upfront capability in terms of skills and those in their 50s. We have something of a gap, which we are bridging, but we have been able to achieve that growth in capability in the 20s and 30s because of the programme.

There has been a stop-start, but we have continued to invest. I think this year we have recruited 130 graduates and apprentices. It is a continuous challenge. Young people today get behind the need for nuclear. Many people in universities recognise that nuclear is clean and that it is a key

part of the energy mix going forward, so we have the case and what we need is that plan.

Q154 **Chair:** Mr Baldwin, what is your perspective on the skills needs in the sector now and in the future?

***Ivan Baldwin:*** Thank you for inviting me to join the panel this morning. I should also mention that, in a voluntary capacity—and it is counterintuitive—I am the president of Women in Nuclear UK, the first man to hold that position in any of the global chapters. That is very much about those of us in the majority looking at how we can better help open doors for other people within the sector. Perhaps I have some different perspectives to bring from that.

Bechtel, the company I represent, is a major engineering and construction business. We deliver across all sectors. We have been in the UK for 70 years. We built the channel tunnel. We led on High Speed 1 and recently helped deliver Crossrail in a major delivery role.

In terms of major project delivery, which is what new nuclear power is, a significant proportion of the skills required are not nuclear skills. We are not looking at incredibly specific and technical roles across the whole piece. Perhaps it is 20% of the population that you are looking at. From a skills perspective, a significant number of people are already out there who have been developed for other industries and other sectors that we can tap into. That is one issue.

I would also look at nuclear communities. I live in west Cumbria, which has one of the bigger populations of nuclear workforce anywhere in the UK. I heard mention of the North West Nuclear Arc, which it is very much a part of stretching into Anglesey in north Wales. A significant amount of work has been done there at the front end, as Dawn was speaking to, regarding the development of the education system and technical colleges in those regions that is really building up the pipeline.

The key, looking forward, is how we honour our commitment to those young people. We have essentially built them up and promised them this opportunity, this programme of work. We are starting to build up the skills pipeline, but are those opportunities there? It very much fits in with some of the points that Dawn was making earlier.

Q155 **Chair:** Thank you very much indeed. Corhyn Parr is now visible to us. I hope she can see and hear us. On this skills question, Ms Parr, you chair the Nuclear Skills Strategy Group. What is the strategy that the industry and the group you chair propose to deal with the needs that the industry will have in the future?

***Corhyn Parr:*** It was great to hear Dawn mentioning all those key points. The Nuclear Skills Strategy Group was created a few years ago to bring all the major employers together, including EDF, the NDA, the AWE, the MOD and the new SMR programme, to look at the long-term skills needs for the future. One of the points that has already been made is the need

for a programmatic approach and real confidence in the long-term future. It takes time to build skills for nuclear. We are really competitive against other major infrastructure programmes around those skills, such as project management, commercial management and so on that are not necessarily nuclear-specific.

We have been able to look at the long-term plan between now and 2050 if we have to deliver our defence programme, our decommissioning programme and the proposed new build programme of 24 GW. Currently, we hire about 3,000 people a year into the sector. With all those programmes working together, we will need about 10,000 to 12,000 new recruits every year. Some of those recruits, as Ivan mentioned, are not necessarily nuclear-specific skills. We will be competing against other infrastructure projects and programmes. It is important, therefore, to focus on STEM—we take a huge amount of resources from the STEM academic arena—and to provide those regional opportunities.

We have been heavily involved within the GBN review recently and the Kingman review by the Cabinet Office. The recommendations we made are fairly clear, and they are something we will continue to move forward with as a group. We cannot afford to hold back on those interventions. That is around certainty to the supply chain and major employers. It is around honing our market intelligence and analysis, and making decisions on what the future build programme could look like. We have very detailed knowledge around what each type of technology could need from a skills point of view. However, the timings of those and the ability to level the requirements over that long period will help us train and re-utilise staff within our sector so we do not lose them. We lose thousands of staff when we halt and move programmes as they look for alternative recruitment outside the nuclear sector.

The fact that nuclear energy is considered clean energy is essential as part of our net zero ambitions in the UK. We are starting to attract a younger, more vibrant and energised group of individuals. Our apprenticeship programmes, our training programmes and all the national colleges and laboratories are essential to making sure we can bring them into the sector, train them and get them out into the workforce as efficiently as possible.

Q156 **Chris Clarkson:** First, I am glad you mentioned the North West Nuclear Arc. There are two Greater Manchester MPs here. I have a college on my patch that is contributing to that, so I am really fired up for it.

I want to talk about international comparators. I have a very good friend who is also from Cumbria. He has worked most of his career in the nuclear industry in France, because that is where all the opportunities are. We obviously have issues there. We clearly have a skills shortage, as Dawn mentioned. How do we bridge that, and what can we learn from international comparators? Obviously, some countries have maintained their nuclear fleet in a way that we stopped doing for a while.

***Dawn James:*** You have given me a great segue into comparing our approach to nuclear in the UK with France. In France, the nuclear industry is a source of national pride, and everybody talks about it. It was at the centre of their recent election. It is something that people want to be involved in; it is considered to be at the heart of who they are. As a consequence, they have built up this great nuclear industry over many years, with 76% of their power coming from nuclear sources. Like us, their stations are aged and they are keeping them going. They now have a declared programme to build between six and 14 EPR2s over the next few years. They are going to be looking to take as many people as possible and to keep as many of them as possible in their industry. It really is at the heart of who they are and what they do.

I am not sure I should, but I will use the phrase "the national narrative." They are proud of it. We should be proud of our industry. We should make it something that we talk about, so that young people aspire to be a part of it and can see their whole career being in it. It has only been in recent years that I have had the confidence to talk about what I do and the fact I work in the nuclear industry. We can help ourselves attract people into our industry if we change the way we all talk about it.

There is one point that we did not touch on earlier, if I could go back to it. There are some very specific nuclear skills that we need during construction, notwithstanding everything to do with licensing and nuclear operations. I will give you a specific example: nuclear-coded welders. We have not been doing a huge amount of pilot work and welding that requires that standard of welding. It is a failure that has existed in the industry.

For the last eight years, up until May this year, I was on the main board of the ECITB. It has been looking at what the market failures might be. It identified nuclear-coded welders as being a specific issue. That is a very specific example. There is a need to look at where the key risks are with those very specific skills in construction—Corhyn is waving her hand, and she obviously has that list—and to make sure we are investing now so that we can effectively deliver.

**Chris Clarkson:** I have very good news for you on that one. There are two national boot camps for welding, and one of them is in my patch.

***Dawn James:*** Excellent.

Q157 **Chris Clarkson:** You have talked about diversity in the nuclear workforce. It is an issue because even the apprentices being trained on my patch tend to be male, pale and stale—well, not stale but male and pale. What is the French nuclear industry like for diversity? Is it still male and white, or is it better?

***Dawn James:*** I am responsible for the business we have in France. In all honesty, I do not see it being significantly different from what we have here in the UK. We are seeing more women progress to senior positions.

It is that middle group. I cannot, hand on heart, say that what I am telling you is correct, but my window into France tells me it is not that different. Let me go away and—

**Chair:** That would be helpful.

**Chris Clarkson:** If you could, that would be smashing. Perhaps there is something they are doing that we are not, trying to attract more women, more people from minority backgrounds, more people from working-class backgrounds, people who have not traditionally gone to university. It is important that these opportunities are there for everybody and lots of people do not know they are. Sorry, I have gone off on a tangent.

**Chair:** A very relevant one.

Q158 **Chris Clarkson:** I am really quite keen on apprenticeships. Is there anything else that you think we need to be doing to encourage this workforce? My concern is that, if there is no plan at the end of it, a lot of these people will be highly skilled in an area in which they will not be able to get jobs. Is there anything the Government need to be doing now to ensure that does not happen? Is it going to be a statement of intent, a firm plan? Does it need to be a strategy? What does it need to be?

***Ivan Baldwin:*** I will give a perspective on that question and come back on the international experience. Consistency of messaging is absolutely crucial. We have COP27, where there is an opportunity to stand on a world stage and talk about some of the solutions to climate change. It is more politically safe to say, "Get behind renewables." If we listen to the President of France, he feels it is very safe to talk about getting behind nuclear.

If we want to attract young people who want to make a difference to climate change, who want to make a difference to society, hearing people at the top of Government saying that nuclear is key to that can have a fundamental effect.

I speak to a lot of young people. I was a trustee of a local charity in west Cumbria for quite some time, the Phoenix Youth Project. You talk to those guys and girls. Even in a nuclear community, they do not quite understand that nuclear is a part of the fight against climate change because they are not hearing that from the so-called grown-ups. That is really important.

To give you a quick perspective on the US market, one of the key things there, and we have talked about it so many times today, is that there is an actual market. They are coming to the completion of the first large-scale nuclear power station in a generation at Plant Vogtle, which is the AP1000 technology from Westinghouse that might become part of things over here as well. You have lifetime extension plans for the various reactors across the US. You will know that nuclear provides 20% of the electricity there. Some of those reactors will deliver past 2050. There are

also major investments in SMRs. They have invested in SMR and in advanced nuclear. It is a combination of Government and private investment.

In our case, we are working with a company called TerraPower, chaired by Bill Gates. Tim referred to it earlier. We are building a first-of-a-kind technology called Natrium in Wyoming in the community of a former coal-generating power station. That will be transformational in that community. It takes a local community out of the problem zone in adding to climate change and being part of the solution. As somebody who comes from west Cumbria, to think we might have that there, energy hubs, et cetera, is key. Placing nuclear in that mix will help us to bring in the talent we need for the future.

***Corhyn Parr:*** I have a little bit of good news. We are seeing a real increase in apprentices coming to the sector, for the reasons we mentioned earlier. The female apprentices are up to nearly 40%. At those lower levels, we are attracting more women into the sector. Graduates are at about 33% and all recruitment is 40% female. We are still lagging behind at about 20%, even though we made a commitment some years ago to increase it to 40% by 2030. We need more active management of our gender and other diverse networks to put nuclear on the agenda.

The fact we have been in the public domain over recent months and years really helps the conversation. We have been able to develop some curriculum, lower-level research and available information. However, it is not on the national curriculum; it is still a choice for schools to run the information we have.

One thing we can look at, and we recommended this in the Kingman review and GBN, is to de-risk some of those apprenticeships and enable a central pool to train some young people, give them the surety of a role in the future but not necessarily a company to be aligned to. That helps generate a sponsor pool of apprentices as well as T-Level vocational courses to attract those younger years. We are losing graduates to other sectors. We do not have enough STEM graduates. Anything we can do to elevate the position of the sector through long-term job prospects will help with that graduate intake.

**Chair:** We have slightly less than 20 minutes before our colleagues on the Committee need to go to Prime Minister's questions, so I ask for short answers to the questions that Rebecca Long Bailey will pose to you.

Q159 **Rebecca Long Bailey:** You touched on a few areas where there are skills gaps. For example, Dawn mentioned nuclear-coded welders. More broadly, what types of skills are required to build the nuclear projects proposed in the given timeframe, and the long-term decommissioning and storage, which is of vital national importance?

***Corhyn Parr:*** Starting at the top level, you are talking about construction, obviously, but also manufacturing, operational resources

and skills, engineering, project and programme management, commercial and financial management, and real scientific, technical, health and safety, and environmental management, as well as all the trades and business functions that support them. There is a huge set of skills requirements.

When we looked at the risk areas—and I will try to be brief—in decommissioning and operating, looking at the defence programme and supporting 24 GW, we have a top 11 of skills priorities. They include nuclear engineers and systems engineers, operators, welders, civil and structural engineers, and nuclear safety case managers. Alongside those real nuclear skills are project planning and control, IT and telecoms. The digital environment is changing so quickly within our sector. We are supported there. Then there is standard mechanical engineering and commercial management. We have a risk and a skills map to start focusing our interventions across the sector.

Q160 **Rebecca Long Bailey:** Ivan, is there anything you would like to add? To touch on the point you made about Anglesey, I know that a lot of their local colleges and higher education institutions were geared up to provide courses linking into the proposed Wylfa site. What were they doing well in Anglesey? How can we tighten up the skills offering?

***Ivan Baldwin:*** There is not a lot to add to what Corhyn has described. It was a great picture. It is such a colourful opportunity in terms of the different types of careers you can have in nuclear. The risk we need to think about is the top talent. Those who are going to drive projects and make projects successful now have a significant number of opportunities that they can look at overseas. We are starting to see first-mover advantage from places like Poland, with the Czech Republic not too far behind. There are different places starting to push for those skillsets. We need to be well aware of that. There is still an opportunity for us here. If we get out of the blocks, commit to Sizewell C and commit to other parts of the project, we can keep those people here.

Thinking about Anglesey, Ynys Môn, we were with Coleg Menai last Monday. We had an Anglesey skills day in Parliament with them. A significant amount of money was spent by private investment into those local institutions. It was quite remarkable that they put that level of faith into the process that it was going to pay dividends in the long term, and we are building up that broad skills base that Corhyn was talking about.

It is quite sad for the island, but I guess positive from a broader nuclear perspective, that the majority of those young people who had apprenticeships through those different providers had to go to Hinkley Point C. There was no future opportunity for them in Anglesey. That was Hinkley Point C's gain and clearly would have been great for the project. If you are in a place like Anglesey, and I am an Englishman who goes to Anglesey very often, it has seen an influx of second home buyers into that environment. There are no long-term careers for young people who can protect the Welsh language, culture, heritage and vibrant community.

That is a big challenge, and we hope to resolve it through the project we are putting forward.

***Dawn James:*** I have nothing to add. Corhyn answered your question beautifully.

Q161 **Rebecca Long Bailey:** When we talk about a green transition, we often say we want it to be a just transition. What scope is there to transfer the skills in sectors that are going to be affected by this transition, such as coal and gas? Are there any particular areas where you can see a direct transfer of skills into the nuclear industry?

***Corhyn Parr:*** Yes, absolutely. We have also looked at the oil and gas sector, although that is starting to warm up again. We are looking at those adjacent sectors where we can attract and retrain, where necessary. There are lots of positions, as I said, around standard project management and systems engineers that do not need a nuclear specialism. They can transfer into our sector very quickly. There are all kinds of training modules run by colleges, as well as NSAN, to provide that basis of nuclear understanding to allow standard engineers, project managers, electricians and so on to come into the sector and have that top-up of nuclear skills. Half of the roles at risk are not nuclear-specific, and we must understand that. We are competing for those roles against other infrastructure projects and the international market.

***Dawn James:*** Employers are also setting up programmes. For example, Jacobs set up a "new to nuclear" programme, which we are sharing with clients and other organisations in the supply chain so that we can bring people in who are further through their lives and retrain them. As Corhyn said, we do not need all nuclear skills. However, we do need people to understand the industry they are working in and to understand, whatever role they are playing, that they need to be nuclear professionals. We are bringing people in and training them, and we have a big programme under way to do that.

***Ivan Baldwin:*** You have covered off all the major points. To take us back to Dawn's point about coded welding being a classic example, I used to work in an SME manufacturing business in Carlisle. We used to deliver equipment to the oil and gas industry. Because we were relatively close to Sellafield, we had been delivering into the nuclear programme for quite some time. The delta was not massive. You get a highly trained, skilled welder who can deliver a pressure vessel for the oil and gas industry. The delta to nuclear is not a massive jump; it is important, but it is not a massive jump to get there. From a capability perspective, there are a lot of organisations that can feed in here.

Q162 **Stephen Metcalfe:** If there are skills gaps, whose responsibility is it to fill them? What is the role of Government in promoting the skills that we need, whether it is in nuclear or in other sectors where they could cross over? What can the Government do, and at what point should they be trying to do it within the curriculum?

***Dawn James:*** I feel as if I am on repeat, and I do apologise. The role of Government is to set the strategy, to set the future direction so that schools can set their curriculums accordingly. The Department for Education can make sure that what we need is coming through the pipeline. That initial intervention is the critical one, to make sure that we are educating our young people in the right way and, as Corhyn said, changing the narrative, with the grown-ups talking about it so that people see that it is of national importance and can see a long-term career.

Q163 **Stephen Metcalfe:** In that case, is it the Government's role to facilitate that knowledge within various levels of the education sector? How does that work practically? Just setting a strategy often does not deliver.

***Dawn James:*** Absolutely. It is determining that we, as the UK, will deliver nuclear power over the next few years, determining what skills are needed for that, working in conjunction with the likes of NSAN and other bodies, and then determining what skills people need—no, let me change that—how people need to be educated, what they need to know so that they can develop their skills as they leave school, either going into further education or moving into roles that may be more technician-based or more construction-based. The school curriculum needs to fulfil the needs of UK plc. That is where the Government come in.

Q164 **Stephen Metcalfe:** Does it do that at the moment?

***Dawn James:*** I am not in the education system.

***Corhyn Parr:*** We provided a suite of information to support the curriculum in schools. We contacted over 2,000 schools to provide that. It is available online. The challenge is that it is not within the curriculum per se, and schools have the opportunity to take it on board or not. We set up the availability of it. As Dawn said, it is important to set a long-term plan for nuclear, and nuclear being part of the UK's energy mix. It is happening. We are seeing that happening now, and it will certainly help.

Further developments are the T-Level vocational courses. In nuclear, we struggle because of the young age groups of those taking up the courses getting some real-life experience. We, as a sector, must look at security and safety requirements of younger trainees coming into our sector. In addition, a Government-sponsored pool of apprenticeships for the longer term will help us to give them job security. As Ivan said, we lost a bunch from Anglesey who had done their training. We need to look at it at national and regional level, where we can keep skills in a local region and develop them. It is also the employer's job. Skills are an employer's job. We, as major employers, have to take that up. That is why the Nuclear Skills Strategy Group tried to bring all those major employers together, to look at interventions that we can work and operate as a group for the benefit of the sector.

***Ivan Baldwin:*** I am a member of an academy trust in Cumbria. One issue I would reflect on, building on the point Dawn was making, is that

in many respects the Department for Education is the Department of our future workforce. Thinking of net zero, in particular, and nuclear's role in net zero, if it is not already, it should be a fundamental part of the curriculum moving forward and, building on that, connecting young people with future employers in a more meaningful way. In Cumbria, something we have done and excelled on is the Gatsby metric and how you get that real connection. Often you hear it from teachers, "We don't know about the world of work outside academia." We in the world of work say, "Well, special people like me who left school at 16 don't particularly know about the world of academia either." Helping to foster that relationship is very important.

Q165 **Stephen Metcalfe:** Excellent. You have pre-empted my next question. I suspect there are good connections where there are existing nuclear plants, better than where there aren't any. What role do you see Great British Nuclear playing, if at all, in spreading the net wider to areas where there may be the talent and the enthusiasm for it but not necessarily the knowledge?

***Dawn James:*** I see Great British Nuclear's role as being the hub of what is needed to deliver the programme. At the hub of this wheel, there are all the different spokes. They will have a role of overseeing and working with various stakeholders. One key area is around skills: working with an SSG; working with employers; working with the Department for Education; setting the programme and making sure that the skills that are needed— the pipeline—are well understood and what is needed to be in place to deliver it is in place.

***Ivan Baldwin:*** One issue is the enablement of small nuclear and advanced nuclear. It could have significant effects way beyond the local communities in which the reactors will be hosted. Lots of that build will be in the manufacturing environment—the midlands, the wider north-west and the north-east, wholly different parts of the UK. Those types of programmes being supported bring a much greater benefit.

The other interesting point, and perhaps it is because nuclear is a well-paying industry, is that people travel very far to deliver nuclear jobs. In some instances, they will drive 80 miles. That is becoming even more effective post covid now that we have found we can do much of this work from afar. My office is in London and I live in west Cumbria. We are showing that the spread of the nuclear economy can be much greater moving forward.

***Corhyn Parr:*** GBN is great. It is a real catalyst for keeping our focus on the long-term future of skills. We must be clear and look at our defence mission here as well. That will have a huge impact on the civil nuclear and the new nuclear build programme. We need to look at skills in the whole.

I echo what Ivan said about nuclear skills and organisations being developed outside the standard local nuclear geography, the STEP

programme, the SMR programme. These are real opportunities to build skills across the UK. If we can tie that up with a real focus and signage from Government that these are fantastic, long-term, high-quality, well-paid jobs, we should be able to create a next generation of people who are desperate to get into the sector instead of financial services.

**Stephen Metcalfe:** Fantastic. That is a great point to finish on.

**Chair:** Indeed it is. I thank our witnesses on this panel: Ivan Baldwin, Corhyn Parr and, especially, Dawn James, who has done a double shift in front of the Committee at immediate notice.

***Dawn James:*** Thank you.

**Chair:** Thank you to all our witnesses this morning