HOUSE OF LORDS

Industry and Regulators Committee

Corrected oral evidence: Ofgem and net zero

Tuesday 16 November 2021

11:35 am

Watch the meeting

Members present: Lord Hollick (The Chair); Lord Blackwell; Lord Burns; Lord Curry of Kirkharle; Baroness Donaghy; Lord Eatwell; Lord Grade of Yarmouth; Lord Reay; Lord Sharkey.

Evidence Session No. 17 Heard in Public Questions 176 - 185

Witness

I: Tom Samson, CEO, Rolls-Royce SMR.

USE OF THE TRANSCRIPT

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

2. Any public use of, or reference to, the contents should make clear that neither Members nor witnesses have had the opportunity to correct the record. If in doubt as to the propriety of using the transcript, please contact the Clerk of the Committee.

3. Members and witnesses are asked to send corrections to the Clerk of the Committee within 14 days of receipt.

Examination of witness

Tom Samson.

Q176 **The Chair:** Tom Samson, a big welcome to you. Thank you very much for joining us today.

Tom Samson: Thank you, sir.

The Chair: We are particularly interested in your views on the consortium that you head, but more generally it would be helpful if you could commence by sketching out how you see the nuclear market developing from where it is now and what possible percentage of the energy mix it should be, what baseload it should be—we have heard quite a wide divergence on that—and your thoughts and estimates about the timing. This is very much the longest part of the cycle, and quite a few of the proposals that we have heard on the nuclear side bump up against the 2050 deadline. Broadly, what role will nuclear play, from your point of view, and then perhaps we can discuss with colleagues the particular products that you are talking about.

Tom Samson: Thank you. Certainly, the perspective of the nuclear industry is that net zero needs nuclear. Without nuclear in the mix, it will be virtually impossible to achieve the net-zero targets by 2050. We can look at various estimates for what that capacity and grid size need to be by 2050. Some say that it will be three times as big as the grid we have today, and there are various scenarios about how quickly we decarbonise and how much larger the electricity grid needs to become to host electric vehicles and heat pumps.

We have done a number of studies. In all cases, while the absolute consumption of energy might vary, the absolute need for clean electricity in all scenarios is significantly larger than it is today. Furthermore, with increasingly large volumes of renewable in the grid, there is an increasingly more important role for baseload technology to provide that grid stability to ensure that a stable baseload is available 24/7 to provide consumers with access to clean energy when the wind does not blow and the sun does not shine, which is quite a lot of the time. The need for there to be a stable form of baseload that is clean is again the right application for nuclear. There is no better source today of clean energy that is available 24/7 than nuclear energy.

On top of that, we potentially see the opportunity for more off-grid applications as customers look to dedicate clean-energy solutions to their data centres, such as an SMR, hydrogen production, synthetic fuel production, industrial heat applications, or in other countries potentially desalination, et cetera. The ability to marry up dedicated 24/7 clean energy solutions with increasing demands for clean energy to produce other decarbonising industries such as transport and heat further increases the role that nuclear can and should play.

But I think it is fair to say that nuclear does not have a free pass. Unless we can deliver a cost-competitive and reliable solution that can be built on time, with credibility, the industry will continue to face challenges and criticisms. That goes in part to the Rolls-Royce SMR that we have designed, as a solution that responds to that unprecedented demand with a product designed specifically to meet a set of market criteria. I will come on to that in more detail as you wish.

Certainly, with more renewables in the mix, there is a significant importance on the need for that clean baseload. In this country, we have not built a baseload-generating plant for probably 20 years. I started my career with Lord Weinstock in GEC Alstom during the "dash for gas" and we built lots and lots of combined cycle gas-fired power plants on the back of the existing coal and nuclear fleet that have given us a baseload flexible source of generation for the last 20 to 30 years.

If we look forward now to 2030, where does that stable baseload come from when the coal plants are shut down and the nuclear assets for all intents and purposes except for the one that is running today have been decommissioned, and what impact might that have on the capacity market and the pricing of electricity?

Nuclear has a really important role to play, I believe, from 2030 onwards. If anything, we should have done more nuclear in the past, so we have a lot of catching up to do, hence why we are excited about bringing this new technology to market.

The Chair: What percentage would you be aiming at when you sit down and look at the market opportunity in your consortium? By the way, it would be interesting if you could tell us a little about the members of the consortium. When you are looking at the market opportunity, are you simply saying that we should be looking to replace the part of the market that is going to be decommissioned or that we should be going for a higher number? What sort of framing do you have?

Tom Samson: Just replacing existing capacity is one layer, but that is certainly not our ambition. Our ambition is that there will be significant demand over and above that to drive demand. A lot of people have referred to it. We have 16 units in the UK as an ambition. Frankly, we have much more than that as an ambition in the UK. We are targeting a market that is determined by the need for low-cost and deliverable clean energy. If we can provide a product that does that, our market could be very exciting.

We have an intention to build a global business. This is not just about the UK. An important differentiator for how we look at this industry is that we are the only UK clean energy product that can be exported globally to address this transition in other countries and an 80% UK content by value solution that will be manufactured here in the UK. When it comes to numbers, in the UK we could easily see a capacity for at least 20, if not 30, SMRs by 2050.

The Chair: Who are the members of your consortium?

Tom Samson: We had a consortium in the previous phase, phase 1, where, together with Rolls-Royce, we created a consortium to strengthen our capabilities by bringing in civil engineering companies, fuel design expertise, consulting engineers and power plant designers. That consortium in phase 1 consisted of Rolls-Royce; Atkins, or SNC-Lavalin; Jacobs; Assystem; BAM Nuttall, from the civils; Laing O'Rourke, from the civils; NNL, the National Nuclear Laboratory, who do a lot of fuel work; the Nuclear Advanced Manufacturing Research Centre in Sheffield; and the Welding Institute to help us look at technology for welding in the technology application. That was up through phase 1, and those partners joined us in sharing that risk in that phase in bringing capital to the programme and helping us to match-fund with the UKRI grant for phase 1.

We are now into phase 2. As of last week, we have launched Rolls-Royce SMR Ltd, a new, stand-alone, independent entity majority owned by Rolls-Royce, and we have sold equity in that vehicle to fund the next phase. That equity has been bought by BNF Resources, which is owned by the Perrodo family—a family wealth fund managing the wealth estate from the Perrodo oil and gas company based in France—and, more importantly, from an industry perspective at least, Exelon Generation, which is the largest commercial nuclear operator of nuclear assets in the world, with the highest performance standards and safety record of any nuclear company out there. So we are very pleased and wear it as a badge of honour to have Exelon as our new shareholder along with BNF.

The consortium partners we mentioned in phase 1 will continue to support us in phase 2, and the money we have now raised with the UKRI grant funding and the new equity from our investors will be spent over the next three and a half years to take the technology through the GDA. Those same eight or nine consortium partners will continue to support us as supply chain partners with supply chain agreements to provide us with resources and expertise as we continue to develop the design.

Q177 **Lord Grade of Yarmouth:** Thank you very much. From your perspective, do you see any sign of a framework that is likely to deliver net zero 2050 and deliver the private sector investment that we need? Do you have any sense of that yet?

Tom Samson: It is a great question, Lord Grade. I was lucky enough to spend four years in Abu Dhabi in the UAE's nuclear programme. It started with literally a blank sheet of paper in a desert state with no nuclear industry in 2008, and as of today it has completed and built three units with the Koreans, with ENEC as the local entity. It set out with purpose to say, "We want to have X gigawatts of nuclear by 2020". It set up the entity ENEC to deliver it. It gave it the financial wherewithal to make that happen, and it provided the oversight and challenge to make sure that it was delivered—and it got done.

In the UK, if you cannot point to somebody who is accountable for delivering clean gigawatts by 2030, 2040, 2050, and that entity does not exist, you have to ask: how is it going to get done? That is a really good question.

There are conversations taking place about trying to create that type of focus, maybe with some kind of delivery agency within government—a very small team. In my time in Abu Dhabi, as well as nuclear I was involved in building out their power and desalination sector. The Abu Dhabi Government had a very small team with 15 or so people, a bit like the delivery agency I mentioned. They have delivered over the last 15 to 20 years over 20 gigawatts of power and desalination projects and brought in about $17 billion of inward investment with a model that they replicated project after project. It does not require the recreation of the CEGB to make this happen. It requires a very small, dedicated team, but with clear accountability, focus and drive to deliver on the intended outcome for clean gigawatts by 2030, 2040, 2050. There is a need for that kind of agency to be created.

In the absence of that, I have to say in all fairness that I have been in the UK for the past six years trying to make nuclear happen—I was previously with NuGen in West Cumbria—and in all my time over the last six years I have never seen the level of government purpose and determination on nuclear that I have seen in the past 12 to 18 months. The 10-point plan, the energy White Paper, the net zero strategy and the recent activities around the RAB are all now pointing to a determination by government to make sure that nuclear is part of that mix and is seen as an essential part of our energy mix in the UK. That is very positive.

We have already demonstrated against that backdrop that we have been able to bring new private capital alongside Rolls-Royce into Rolls-Royce SMR Ltd, accessing the government grant to enable us to go forward into the GDA, and now we look to how we deploy the technology. The real prize here is: when do we start delivering units in particular locations and building these reactors and SMRs across the UK and globally?

For that deployment path, we are in discussions about how we can get the support needed to make that happen. Is it the CfD? Is it the RAB? We think that the CfD is available today and something we could work with, with government support. The model that we have brought to market has been specifically designed to be investable and is effectively a factory-built commodity to make it what we believe to be an investable proposition. We will try to bring in as much private capital as we can to deploy the technology.

With the small modular reactor solution, our vision is to get to a place where we are not reliant on the Government to make all the decisions in what to invest in and to make nuclear happen. It can be done with private capital and make nuclear much more accessible to a wider group of customers and stakeholders than the large programmes can be.

Lord Grade of Yarmouth: Can I drill down a little more into what is

required? We are a bit schizophrenic about nuclear in this country, are we not? I can see the planning inquiries all around the country where you are trying to build these things. It is going to be a nightmare, is it not? What do you need to make it happen? Does Parliament have to be very dictatorial about this to make it happen? It has taken us 35 years and we still do not have a third runway.

Tom Samson: It is a great point, Lord Grade. Being more deterministic is absolutely essential. Equally to your point about planning and local communities, there are existing communities in the UK that have hosted nuclear assets for the last 50 years. Those assets have now been or are being decommissioned. Places such as Anglesey in north Wales, Trawsfynydd, West Cumbria, Heysham and Hartlepool all have nuclear estate on them, and there are other new parts of the nuclear decommissioning authority's estate.

Lord Grade of Yarmouth: There are not enough of them, are there?

Tom Samson: Even within the first three I mentioned—Trawsfynydd, Anglesey and West Cumbria—we could get 15 units over the next 15 years. That is absolutely within our gift. Those communities are massive advocates of nuclear. They understand it. They are not fearful of it. They see the economic benefits of it. Indeed, they want SMRs in those communities. I have sat down with the MPs in Anglesey, West Cumbria and Trawsfynydd, and they all have one very clear message for me: "We want SMRs in our community. We want to see the inward investment. We want to see the jobs, and our communities will embrace that".

Locally, there is no opposition as such. Where we see the big difficulty, back to your question about the Government's role, is the planning process, DCO and permitting. You really need to think about the rationale for going through a four-year, five-year or lengthy multiyear process from a planning perspective to put a small modular reactor on a site that has had a nuclear asset for the past 50 years in a community that applauds it and wishes it to happen at pace. There is an opportunity for us to go faster, and with the backdrop of COP 26 and climate change, and the urgency of bringing clean power to the grid, we somehow have to reconcile those procedural permitting sequences with the urgency of bringing clean power to the grid.

Lord Grade of Yarmouth: That is a great point. Is there a lot of excitement about this product outside the UK from countries that might have been nervous about extending their nuclear?

Tom Samson: Absolutely. I was invited by the IAEA to sit on its Group of Vienna, which is 20 CEOs from the global nuclear industry, with the new director-general Rafael Grossi. We talked about the common challenges of nuclear. Interestingly, whether it is Brazil, Argentina or Europe, there seems to be a sentiment that nuclear has some challenges, but universally people welcome SMR. They see SMR as a different way to deliver nuclear. We have come up with a radically different way—driving

out construction risk, making it much more predictable and manageable by building it in a factory. That is creating a lot of excitement.

We have just had a team come back from Prague in the Czech Republic talking to the utilities there about deploying the technology. We spent six months last year working with EÜAŞ in Turkey on a feasibility study to deploy our technology at scale there. We see huge interest in central Europe in places such as Poland and Romania. They do not have the levels of offshore wind that we have in the UK and, equally, they do not have access to large volumes of gas. They know that the end of coal is in sight. So there is huge potential. That is one of the other challenges and why we are really keen to move at pace in the UK, because once we can point to that UK deployment, the international market will open up.

Lord Grade of Yarmouth: Is this model world-leading?

Tom Samson: Absolutely. In the 50-hertz market there are other SMRs. NuScale has achieved its design cert in the US with the NRC. In the 50-hertz world we are leading the world and we must take advantage of that first mover advantage in the UK by getting to deployment quickly so that we can unlock that global opportunity. Others will try to catch up. EDF has just announced its own small modular reactor. It is behind where we are today, but if we do not move at pace and continue this momentum it could very easily catch up and take over where we are with its newer design at EDF.

There are other technologies out there. There are about 70 SMRs. They go from a few megawatts. We are the largest at 470, but we definitely have a world-leading product, and if we can now move forward in deploying it in the UK, that global market will be enormous for us.

Lord Grade of Yarmouth: Thank you very much.

Q178 **Lord Eatwell:** I just want to follow up the suspicion, so to speak, that many communities have towards nuclear. It seems to rest on two factors. One is safety issues. Leaving that aside, the other is the disposal of nuclear waste. How have you cracked the second one?

Tom Samson: With regard to the second one, let me put it into context. If every one of us was to use nuclear energy for all our energy needs in our life, the waste that would produce would fill a can of coke. That is the footprint of waste that is produced by using nuclear energy compared to other sources of energy.

Lord Eatwell: Millions of cans of coke would be produced in the UK.

Tom Samson: Again, that is over somebody's lifetime. The point about the waste is that it is well controlled, it is highly regulated and it is accounted for. Within our cost of electricity in the UK, we include a funded decommissioning plan that is about 5% to 10% of the cost of electricity, which effectively includes a pension pot that deals with the liabilities associated with decommissioning. We have learned from mistakes from the 1940s, 1950s and 1960s, when that liability built up

and we had to deal with it. We now factor it in to the tariff costs of electricity from nuclear power, so that is a funded decommissioning plan.

Secondly, on a different scale, the fuel that one of our SMRs running for 60 years producing baseload energy would produce would fill an Olympic-size swimming pool. That is another visualisation of how much waste is produced. That is 60 years of baseload from a power plant that could power the city the size of Leeds. That gives you the scale of the waste.

It is interesting, because we are in a world where we are dealing with climate change and looking at the consequences of 2 degrees, 3 degrees, 4 degrees as a result of fossil fuel, an industry that has never been responsible and taken account of the waste it has produced, yet somehow waste has become a barrier to deploying nuclear because of the context, which is not properly well understood. It should not be a reason for not deploying nuclear. It is an issue that we have to manage. We manage it very well. We have a highly regulated industry in the UK. Anywhere else in the world that adopts nuclear power has to abide by those same international standards through the IEA. The standards are there, the regulations are there and the safety is managed. If that is the reason why we do not deploy more nuclear, we are not confronting the scale of the challenge we have ahead of us with climate change.

Q179 **Lord Sharkey:** I wanted to pick up on a report published last week by the Adam Smith Institute.

Tom Samson: I am from Kirkcaldy, which is Adam Smith's home town, so I should have read that. Apologies if I have not.

Lord Sharkey: You may not approve of what Adam Smith said next. The report says that the Rolls-Royce plants are PWRs that were designed for nuclear submarines and not even mentioned in the BEIS list of technical readiness. ANRs are generation IV. PWRs are generation II. They are widely considered to be out of date, Adam Smith says.

Tom Samson: I will commit to reading Adam Smith's article if that institute commits to read the latest works across the industry. We are a gen III+ technology. Our PWR is a gen III PWR, which has enhanced safety features. Post Fukushima, we have added in additional passive safety features. We have a certain degree of walk-away safety systems so the plant can shut itself down safely for a number of days in the event of a loss of site power and no access ability for personnel. Those are the leading passive safety solutions associated with gen III+.

You are right: gen IV solutions advanced reactors use different types of fuel and different types of technology, but, frankly, those solutions are not integrated into the nuclear industry landscape today. When we began this programme in 2015 we chose specifically not to go down a route that was tied to a future fuel that does not exist today, because that means that deployment is even more difficult. To try to deploy a technology anywhere in the world that does not have the molten salt or a different

type of fuel architecture around it increases the burden for deployment in the country and just makes it even harder to take the technology forward.

Given the urgency we have, we chose to go with a proven PWR. Choosing a proven design is one of the reasons why we have come up with a low-cost deliverable solution. It is a proven form of PWR, as you point out. It has all the gen III+ passive and latest safety features built into it, but by building it in a factory we combine the best of proven technology and modern manufacturing techniques, and at 470 megawatts we can access commercially available products such as our steam turbine and our balance of plant, so we are not creating the world's biggest anything in what we are doing. We are tapping into an existing supply chain.

Lord Sharkey: In terms of technology readiness, I think seven is the highest they award. You are ready.

Tom Samson: We are ready to take contracts today. We are advocating that with our conversations with BEIS. We want to go forward now. We submitted a paper to government about 18 months ago called an acceleration proposal on where we can now accelerate this technology. Importantly, we have the funds in place as of last week to enter the GDA. We submitted a generic design assessment with the UK regulators. We submitted the application to the GDA last week. We are hoping that, once BEIS has gone through that and reviewed it, we will be able to enter the GDA process with the regulators that will allow us to engage with the regulators on the design.

We have been having regular engagements with the regulators over the last 18 months to display to them our thinking, our ideas and our technology. It is a very familiar technology to the regulator. There is nothing unusual in what we are doing in bringing a PWR to market. Obviously, the size and the scale are unique to this configuration, so we have to do a lot of verification and validation work to build the test rigs to prove the thermodynamics and flows. That work is also built into our funding for the next three and a half years. The acceleration proposal is about doing things in parallel. While we do the GDA and complete the GDA, we can be preparing the sites that host this technology, and in parallel we can also be building the factories.

This is all about UK content. We will be building new factories to make the modules and new factories to make the heavy pressure vessels. These are world-class manufacturing facilities. We already have experience of doing that at the Raynesway facility in Derby where we manufactured the nuclear reactor technology for the submarine programme. We have 60 years' experience of doing that. That engineering know-how and experience is embedded within this Rolls-Royce SMR programme. Last week, we transferred over 150 people from Rolls-Royce into Rolls-Royce SMR Ltd as part of the new company we have established.

We have built into our DNA that deep, deep experience of British engineering excellence in delivering the nuclear fleet to the submarine programme, as well as manufacturing know-how. Rolls-Royce is synonymous with manufacturing highly complex engineering products in the aerospace industries. If you combine those two legacies together, you have an SMR, and we have strengthened that with the consortium partners I mentioned earlier, including Laing O'Rourke on the civils. It has a civil modular factory already in the UK, and we will be looking to expand and replicate that to build modules for this technology in a factory to minimise the construction activity on site.

Q180 **Lord Reay:** Several of our recent witness have expressed the view that achieving net zero by 2050 will necessitate a move away from a centralised energy model with large power stations and passive customers to a more localised model with a large number of generators, more flexibility and potentially greater engagement with customers. This shift can be applicable to hydrogen as well as to small modular reactors. If this is correct, how does energy policy and regulation need to change to reflect this?

Tom Samson: That is a great point. Take, for example, our ambition to move at pace. Right now we are trying to work on a CfD mechanism and get access to a site for this technology. We are a technology provider. We are providing a turnkey contract to deliver a nuclear power plant. We need to have customers who want to buy that nuclear power plant. Frankly, in the UK today, there is no landscape filled with customers waiting to buy our technology. We have utilities that are dedicated to their own technologies, such as EDF, or we have utilities that are potentially from Germany or countries that have a desire not to build nuclear technology, as well as many other utility companies that have tried to go asset-lite and have not invested in generating assets for some time that are buying the energy from the marketplace. That is a tough landscape for bringing a new technology to market.

We are trying to create a developer landscape to bring together private capital with the necessary enabling elements from government such as a CfD. Effectively, the ambition is to create a nuclear IPP—an independent power producer—that is tied to a nuclear asset. Our partnership with Exelon gives us the opportunity to provide a Rolls-Royce SMR solution with an operator in Exelon that can operate that asset, which therefore makes it possible for heavy energy-intensive users to consider an SMR dedicated to their demand.

We are talking with companies that are operating the data centres. We are looking at creating clean energy hubs off grid that can produce energy dedicated to data centres and produce hydrogen, synthetic aviation fuel, industrial heat and potentially even district heating. That energy hub concept absolutely takes advantage of that decentralisation of the grid. As we look to try to get to three times our current capacity, that off-grid market is potentially significant for us and we think we can play a part in that.

In terms of government regulation, clearly right now we are dependent on the CfD as an available tool that we hope to be able to access. The RAB model as it becomes available in the future might also make nuclear even lower cost to the consumer by taking advantage of the lower cost of capital. Equally, once we get moving, the potential for there to be PPAs as well for nuclear assets further reduces the burden on the CfD.

The difficulty we have from a market perspective with nuclear, even with an SMR, is that these are 60-year assets. In the market today, if you were to buy a long-term PPA, it would probably be for five years. You cannot finance a nuclear asset even at £2 billion with an SMR on a five-year contract. We need some kind of longer-term bankability built into the contracting structures, which is why we are focused on CfD and possibly RAB in the future to try to deal with that short-term aspect of the current PPA market. But we think there is an increasing demand for PPA offtakes. Our view is that we can combine more and more PPAs over five to 10 years with a CfD so that we further diminish the burden on the Government in taking that CfD exposure. In all cases our goal is to minimise and avoid the impact on the Government, whether it be by maximising private capital to finance an SMR or supplementing the CfD with multiple PPAs to reduce the amount of energy that is tied up in the CfD.

Lord Reay: I have a slightly different question. How do you make terrorist-proof the reactors that you put in places other than where nuclear sites are at the moment?

Tom Samson: I can touch on that by talking about the UK regulator. The UK regulator oversees our design to ensure the highest levels of safety, security and environmental sustainability. We expose our design fully to the regulatory environment. We are fully signed up to the highest performance standards of quality, safety and sustainability in what we do, and we have a very close relationship when it comes to security aspects with the security authorities and the requirements for design-basis threats to be built into our design. We are very much focused on ensuring that all our threats are identified and our design is fully compliant with those extreme threats so that they provide the same level of robust resistance to those threats as the existing nuclear architecture in the UK does today.

Q181 **Lord Curry of Kirkharle:** What needs to happen for your contracts to be extended beyond five years to make an investment worth while?

Tom Samson: That is why I go back to the CfD. We could probably find customers in the marketplace who might want to buy our power from our development company that needs to be set up to own the asset from where the private capital comes. They will be looking to sell the power. They will need a CfD over a long period to give them certainty to be able to finance that investment.

In the short term, the five to 10-year PPAs can reduce the dependency on the CfD. Let us say that the CfD is for 470 megawatts for 30 years. For

the first five or 10 years, you might be able to sell all the power through a PPA, in which case the CfD is providing you with the tail over the remainder of the time needed to satisfy the investment criteria for the funding coming in to finance the SMR. It is kind of a combination of the two. Every PPA we can secure diminishes the need to rely on the CfD, but you still need the CfD to provide that longer-term certainty from an investment perspective to make sure that the price is agreeable to the capital coming in.

Importantly, we expect our power plants to be at about £60 per megawatt-hour. That is a very cost-competitive starting point in terms of the exposure we expect to be protected by the CfD. So the CfD is a market protection mechanism, but we are setting that threshold relatively low. If you were to talk to industry experts about where they think the power prices might be in 2030 and beyond, given my earlier point that we have not built any baseload, the prices might well be significantly higher than that. Suddenly, the CfD is not necessarily seen in such a negative way if there is a high expectation that prices will be above £60 in 2030 and beyond.

Q182 **Lord Sharkey:** We have heard contrasting views about the desirability of a co-ordinating body for net-zero policies. Some witnesses have argued that such a body would provide more clarity and better planning either as a new body or as an existing body with wider and more powers. Others have disagreed, arguing that energy companies need new routes to escape the dead hand of central planning. If there is a need for a single co-ordinating body, and I think you said that you thought there was, would you see that body as being helpful in attracting investment into SMRs?

Tom Samson: I think you are absolutely right. The evidence of that deterministic approach to delivery of gigawatts by certain dates and the provision of the enabling framework underneath that jurisdiction where there is an accountable body that is responsible for delivering those gigawatts does help to provide the conditions to attract capital to invest in an SMR from the capital markets. I think it is a step in the right direction. Right now, we are trying to create that developer construct with partners who want to invest in our SMR, but the presence of a delivery agency from the Government's side that is accountable for making sure that all these things are happening, and facilitating and enabling it, would be a bonus and an added benefit to that landscape.

Lord Sharkey: Either in your current organisation or your previous one, did you contribute to the BEIS consultation on the future system operator?

Tom Samson: I do not believe we did. We did on the RAB, but I do not believe we contributed to the system operator.

Lord Sharkey: Because that is the candidate for the single body that you are talking about.

Tom Samson: Right, but we have had discussions with BEIS where we have expressed our views on the need for a delivery agency to help with the deployment of SMRs. We have been advocating that with it directly over the last 12 to 18 months.

Lord Sharkey: Thank you.

Q183 **Baroness Donaghy:** At the moment, Ofgem has a limited regulatory role in relation to nuclear, but it is possible that it will play a greater role as it will become the economic regulator, unless the whole landscape changes for the infrastructure of the future. It will become the economic regulator for the regulated asset base that you have referred to. Would that be regarded as an obstacle? What obstacles, apart from the ones you have outlined such as the suspicion about developing more nuclear, do you foresee in the near future?

Tom Samson: I think we welcome the potential for RAB to be available as a technology-agnostic financing solution for nuclear. I think that is a good thing. It provides access to low-cost capital and therefore further reduces the cost of electricity. I mentioned £60 a megawatt-hour for our technology. That is based on a CfD. If we had a RAB with a much lower cost of capital, it could be below £40 per megawatt-hour. That cost of capital is a big factor in determining the cost to the consumer of nuclear power.

What are the other barriers we see? The main challenge we see beyond the market-enabling landscape, whether it be with the delivery agency, the CfD access or the RAB, really goes back to the point I made about the planning process in trying to deliver at pace. We should try to identify what assets we have in the UK that can best accommodate the technology to move at pace. That includes nuclear sites and working through existing arrangements on those sites. It includes potentially going as far as giving the NDA some remit to open up to commercialisation of those assets to help deploy SMR technology within its estate. Based on its current vires, it is not within its remit to engage on that basis.

There is also opportunity to look at how we open up the estate for more nuclear deployment and how we accelerate and simplify the planning process for specific areas where there has been a nuclear estate for many decades if they are going to be the locations for SMRs. Those would be really quite enabling mechanisms that would help us to deploy at pace but also at scale, because for us it is not so much about getting the first unit on the grid. Once we have built the first unit, we have a factory architecture that has been created that can produce two units a year. That is 1,000 megawatts a year of SMR coming out of that factory footprint to be deployed at other sites and exported globally.

Working through the mechanisms to unlock some of those barriers in planning, siting and future locations for SMRs is very important. Fortunately, the Government have an enabling SMR deployment fund in the spending review to work with us on some of those issues. We hope

we can collaborate with folks in BEIS to try to help identify some of those barriers. We have been working with specialist DCO and planning consultants to help contribute to those conversations as well to try to reduce some of those barriers.

Baroness Donaghy: Thank you. You are clearly a very passionate and convincing advocate for your product. In your spare time, would you think about building batteries and creating storage systems, and improving the connectivity to connect together all the varying requirements of the different energies that we are going to have? You refer to these hubs. Do you think there is any prospect of your moving in on those areas that we so desperately need?

Tom Samson: Absolutely. My passion stems from when I studied energy engineering at Napier Polytechnic, as it was at the time, in 1986, which was of course created after the oil crisis in the 1970s. I have been involved in generating power for all my career for the past 32 years, the past 10 of which have been in nuclear. I have also been involved in creating a lot of emissions from the plants that I have built before I got into nuclear. As somebody who has been in the energy industry for as long as I have, I am so passionate about nuclear as part of the solution that that is why I am still here today and trying to take this technology forward.

But you are absolutely right: the opportunity to try to create secondary energy benefits from an SMR is also what is really exciting about where we host SMRs, because not only is the SMR suddenly not just a repurposing of a decommissioned nuclear site that has a need for economic regeneration, but it becomes a magnet for other high-energy users who want to produce hydrogen for export—synthetic aviation fuel for export.

I see SMRs in terms of the future. We have Nick Boyle here from his experience in BP. Oil and gas companies explored for exploration and production assets around the world so that they could have an asset that they could exploit and generate energy from for a long period. The future is that those assets will now be replaced by SMRs. You invest in an SMR and you have 60 years of clean energy that you can use to produce grid power, hydrogen, synthetic aviation fuel, and it becomes a constant source of clean energy that can be coupled with many other uses to help to decarbonise the harder-to-access sectors such as transport and heat.

I really think that SMRs can become that. They are much more digestible and investable, which makes helping other companies today to look at investing in future clean energy by investing in SMRs, unlocking all these secondary benefits and creating clean energy hubs around an SMR a more realistic possibility. That is a really exciting prospect, because then the economic value from it is even greater.

Then there is the export potential. Something that does not get talked about enough is that we have a great oil and gas industry in the UK that we have relied on for many decades. We have exported that product

globally. The future products that will be produced are hydrogen and synthetic aviation fuel. If we do not produce those cost-competitively, we will not be able to compete on the world stage. How we produce those solutions cost-competitively becomes very important, and we are very much of the view that an SMR creates a very cost-competitive source of clean energy for all those other energy products, which can also be exported. It goes beyond just a nuclear site. It is about creating a clean energy industry.

Q184 **Lord Blackwell:** On the regulated asset base model, my understanding is that the current legislation will apply to large nuclear generators built in order to defray the up-front cost. Are you saying that it would be necessary to extend that to SMRs in order for SMRs to become investable?

Tom Samson: That is a good question. Our understanding is that RAB is intended to apply not just to large technologies but to other nuclear technologies as well. Our understanding is that it is a technology-agnostic solution, which I would hope is the case, rather than it being customised for a single product or single technology.

Do we need RAB to deploy our technology? As I say, right now our goal is to move at pace. To move at pace, our focus is to try to build solutions around the CfD. The CfD has been a bankable source of architecture for the offshore renewable and the renewable industry. If we can use that as a way to attract private capital in the next 12 to 18 months, that is a bigger priority for us. We are not entirely sure of the timing of the RAB. Also, we do not want to wait for that to happen to be able to go ahead and look at how we deploy the technology today. But if and when it is available we hope to be able to access it in the future, especially if there is that source of low-cost capital to help drive down the cost of nuclear so that we can benefit from that source of low-cost capital as well.

Lord Blackwell: The disadvantage of the regulated asset base is that it means that the price is passed on to consumers up front, whereas if you can do it through long-term contracts for difference presumably it is the future consumers who pay.

Tom Samson: Yes.

Lord Blackwell: One can see why for a very large nuclear project the investment may not be available without an RAB, but for a smaller-scale SMR you could do that.

Tom Samson: Capital looks at risk, and we have designed this to be a low-risk solution. We have designed this specifically to address the biggest challenge with nuclear, which is construction risk and associated delays. Creating a product that is built in a factory—and by "in a factory" I mean that everything we do, including the work on site, is done in a factory; the first thing we do on site is build a factory—means that 90% of what we do in delivering our SMR is done in a factory to eradicate and

radically remove that construction risk. That allows us to benefit from the factory production environment for everything we do.

That helps us to create both a low-cost solution and a solution that is deployable with more confidence, because we have greater control, we are not exposed to the elements, and we can improve innovation and apply innovations in the factory environment. We believe that what we have created is radically different from how nuclear is delivered on a large scale, and we have done that for a reason: to make it more attractive and easier to digest, but also to make it investable.

We set out four criteria for our engineering team to address. None of them was technical. The solution had to be low cost, deployable, global and scalable, and investable. A factory-built, commoditised approach to nuclear is how we have done that.

By making it investable, we want to attract private capital. I spent six days at COP 26 recently, and from the amount of attention that is now coming towards the sector from banking and financial institutions I would say that the capital is there. The capital is looking for technologies, plans and solutions that will address climate change. It is incumbent on us to bring those solutions to market and maximise how we can access that private capital to deploy this technology at pace.

To answer your question, we are not dependent on the RAB, but we have to make sure that we do not end up losing the bigger picture about the cost of capital. If we have some nuclear that has a cost of capital at 3% or 4% because of the RAB, it will obviously be much cheaper than our technology. If we have the RAB, we can be down at £40 a megawatt-hour. But I am not sure the RAB is intended to reduce the cost to the consumer. I think it is more intended to deal with risk and deployment. We believe we can move at pace with private capital and a CfD, and that is our focus for now.

Lord Blackwell: There is obviously a lot of concern about loading costs on to consumers for the costs of the transition to net zero. If this is a technology that actually can avoid putting those up-front costs on consumers by funding it privately, that might be an advantage, even though you say you have a higher cost of capital doing it that way.

Tom Samson: Maybe you should ask me to come back here when I have the private capital signed up and committed to evidence that. That is where we are starting from today to try to access that private capital based on the strength of the CfD model, and we are certainly going to give our best shot to trying to make that work.

Lord Blackwell: You mentioned that one of the potential opportunities is to tie SMRs into hydrogen production. Is there any interest from the potential hydrogen—

Tom Samson: There is lots of interest right now from the hydrogen technology players. We have ongoing discussions with some great UK

companies—ITM and Ceres Power—so there are lots of opportunities for us to collaborate with those players. Again, we have to look at the whole, holistic architecture. How do we fund the programme that is going to produce hydrogen for 60 years? That is the primary challenge with bringing the private capital in. We are looking at ways to ensure that those technology players in the hydrogen space realise exactly how cost-competitive it can be to marry up with an SMR. It is not just because of the costs; we can also access and integrate heat in other systems to make hydrogen production more efficient. They are the kinds of things we are focusing on with some of those new technology vendors.

Q185 **Lord Grade of Yarmouth:** If you had an absolutely fair wind and the capital was available to you, by 2050 how much of the energy needs of this country do you think you could provide, given that there were no planning problems and you could just roll it out?

Tom Samson: It is really hard to put a limit on it, because we have designed this to be scalable. When we build the first set of factories they can make two units a year, with 1,000 megawatts a year roughly coming out of the factory. If we have higher demand, whether it is because of the need for hydrogen production and synthetic fuel, or more grid electricity, we will just build another set of factories. So that is four units. Another set would be six units. We could be producing 6,000 megawatts a year from the factory footprints if the demand was there. Whatever the demand, we will be able to respond with a scalable solution.

Lord Grade of Yarmouth: How long is it from signing an order to commissioning?

Tom Samson: For the first unit it is longer, because we have to build the factories, complete the GDA and get the sites ready all in parallel. So the first unit that we expect will be on the grid by 2031, if we can get a green light to start going in 2022 with private capital and the CfD, the model I have just described. But then we can produce two units a year, or four or six as we scale up the numbers of factories. We can then plan for the second, third and fourth units to be deployed as we start out with the first. We are exploring options for—

Lord Grade of Yarmouth: Is it three or four years from getting an order to—

Tom Samson: The lead time is probably more like five years. Then you can start to secure your slot on the production line.

Lord Grade of Yarmouth: Thank you very much.

The Chair: Are you saying on the basis of the conversations you have had with investors that they would be prepared to invest before the first SMR is up and running, or will they want to see the first one up and running before they are prepared to invest?

Tom Samson: I think there is capital out there today, with an understanding of the risk that we present, with our technology, with our

single turnkey contracting approach. We are the contractor. We will sign up to deliver a complete power station. When they understand our heritage with the nuclear submarine background and our knowledge in how we are going to design and build the factories, we certainly hope that we can attract private capital to deploy this technology in the coming months.

The Chair: Is that capital coming from the UK or from overseas?

Tom Samson: I think we will be looking to tap into the global financial markets. Certainly that is our intention. There is the issue of taxonomy and there is a bit of a distraction in Europe with Germany and Austria trying to block nuclear as a proper ESG-qualifying source of investment. Some of the markets in the world—for example, the US—are not distracted by that. Hopefully, the UK is embracing nuclear as a proper ESG-qualifying solution for access to the green infrastructure bank or other solutions that might be available to access capital in the UK.

On the back of COP and our launch last week, we will start to increase the dialogue with financial institutions about their risk appetite and risk profile to make sure that what we have as a solution will make that attractive to private capital. When we go to that market, with Rolls-Royce SMR as a technology provider under a single contract delivering a power plant, and Exelon, the most respected nuclear operator in the world alongside us, not only as a shareholder but as a potential operator for these assets, attracting private capital will become much more attainable.

The Chair: When you were in discussions with UKRI, were there any stumbling blocks that concerned it?

Tom Samson: UKRI has been absolutely great in trying to help us innovate through this phase and the next phase. This is still innovation, but we still have to design these factories and create these manufacturing solutions. We have accessed the UKRI support to take us through this. That process has been well received by UKRI and BEIS, so we are now looking forward to working with them and accessing the grant over the next three and a half years to fully access the £210 million of grant from UKRI. It is one of the biggest grants for a single programme ever, and we are really grateful for that level of government support. That is another factor to help make this attractive to private capital. It can see that the UK Government have put money through a grant into developing this technology. That is a signal that the UK Government want this technology to be deployed and successful.

The Chair: Tom, thank you very much for joining us with a very interesting and suitably energetic presentation.

Tom Samson: Thank you very much for listening. I appreciate you guys taking the time.