



Economic Affairs Committee

Corrected oral evidence: UK energy supply and investment

Tuesday 5 April 2022

4.05 pm

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Members present: Lord Livingston of Parkhead (The Chair); Viscount Chandos; Lord Fox; Lord King of Lothbury; Baroness Kramer; Lord Monks; Baroness Noakes; Lord Rooker; Lord Skidelsky; Lord Stern of Brentford.

Evidence Session No. 14

Hybrid Proceeding

Questions 167 - 178

Witnesses

I: Tom Samson, CEO, Rolls-Royce SMR; Tom Greatrex, Chief Executive, Nuclear Industry Association.

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Examination of Witnesses

Tom Samson and Tom Greatrex.

Q167 **The Chair:** Welcome, Tom Samson and Tom Greatrex. Tom Samson, if you could start by just giving a very quick background to yourself, and then if the other Tom could follow up, that would be tremendous. Thank you for coming today.

Tom Samson: My pleasure, thanks for inviting me. I am the chief executive officer of Rolls-Royce SMR Ltd. I have over 32 years' experience in the power industry, the last 10 of which have been in nuclear, helping the UAE develop its Barakah programme before coming back to the UK. I was the CEO of NuGeneration, one of the large new builds in west Cumbria, in Moorside. I have been in this role, pioneering SMRs, for the last two years.

Tom Greatrex: I am chief executive of the Nuclear Industry Association, which is the trade association for the civil nuclear sector in the United Kingdom.

The Chair: If I can start with Tom Samson on SMRs, we have heard a lot, and we are expecting something at some point from the Government, but before we get into the detail, could you just give an overview of the scale and possibilities on SMR: what volume, over what time, and what might it mean for the source of electricity production in the UK? What could be the scale of our ambition?

Tom Samson: Rolls-Royce SMR is a new, domestic source of nuclear technology. This is the fastest way to get a nuclear reactor on the grid in the UK from today. We wrote to the Prime Minister last week, following the round table, outlining how, by removing many of the planning barriers and obstacles, and by giving us a green light to proceed as quickly as possible, we could even have the first unit online by 2029.

These are factory-built products. It is a factory-built commodity as opposed to a large construction programme. The demand signal today can determine how many units are produced in the factory environment. We can build factories to make two units a year. That is one gigawatt; each unit is 500 megawatts. We can build factories to make four units a year. We can build multiple factories to make any multiple of that as needed. It depends on the strength of the demand signal. That is what will allow us to then build those factories and start producing product.

In terms of the scale of the ambition, we hope for something in this week's energy security paper towards the end of the spectrum that is more commitment, action and decisions, as opposed to ambition, targets and aspirations, because we need to make decisions today if we are to bring clean energy to the grid in the next 10 years.

The Chair: When you look at other countries, can you point and say that there is another country progressing upon this route at the sort of pace and with the sort of direction that it should, or is the UK standing alone in

looking at SMR in this level of detail?

Tom Samson: We saw demand for our technology already in many countries, even before the unfolding crisis in Ukraine, just based on the need for net-zero transitions. Not every country is blessed with the volumes of offshore wind that we have in the UK. This is also a global product that we intend to export as part of global Britain. Not only does it improve security of supply domestically and offer levelling-up benefits by building factories to produce content in the UK and net-zero benefits in terms of clean energy; it is also a global Britain export, and we see huge demand.

You can look back in time at other countries that have embraced nuclear at scale and pace, be it France, Sweden, Korea or Japan, and see the evidence they have demonstrated by embracing a domestic technology and deploying it at scale and pace. I was in the UAE programme for four or five years and I saw a country go from no nuclear capability, in 2008, to having 5,000 megawatts of built large plant—or two of the units—on the grid already 14 years later. Those examples demonstrate what is possible with clear, deterministic intervention by government to set the landscape for decisions to begin a programme of building new plants.

Q168 **Lord Fox:** Following on from that, and I apologise for still talking to Mr Samson, on what number of reactors is your business case predicated? I am asking you this because you said we can export them. The last time I saw a presentation from your company, you told us you had to export them to make the business case. Is that still the case? How much of the domestic market will satisfy your business case?

Tom Samson: There are a couple of things to say. First, the cost competitiveness of our technology, in the context of the scale of clean energy demand, indicates to us that the potential market for our technology is enormous. Secondly, in terms of the demand signal and the business case, you do not build a factory to make one car. This is a factory-built commodity. We are progressing this technology because of the scale of the demand, and we believe in the cost competitiveness of our technology.

Cost of capital equations change the value of the LCOE from this technology, but at the high end of the spectrum, using traditional forms of capital, we would be up £70 to £75 per megawatt hour with our numbers, and at the lower end of the spectrum, with a RAB model, we would be in the £40 to £50 per megawatt hour end of the spectrum for clean, baseload, carbon-free energy, which, compared to a renewable plus storage form of baseload, is a very cost-competitive solution.

We anticipate selling many hundreds of these units between now and 2050. That is a business case upon which we have attracted the capital today, and those investors who came to the table in November last year have done their analysis. We have done market studies and research, and with that cost competitiveness there is a huge demand for this technology. That is the premise on which we are building the business.

Lord Fox: Rather brilliantly, you have answered the question I was going to ask you about costs, but I am still going to press you a little. How many units have to be ordered for you to start? In other words, what is the kick-off for you?

Tom Samson: We could start with a unit for one order, but that would be a very uneconomical way to deploy the technology. That is 500 megawatts. Even in the UK context, if we are ambitious to achieve 25% nuclear by 2050, 500 megawatts is a very low contribution to that target. If we could, in the next 12 months, find a commitment in the UK for multiple units, whether that be two or four, we would have a strong case then to go away and build the factories, and start to produce the product.

The Chair: Tom Greatrex, how does that coincide with the large nuclear programme? Having a responsibility for the wider industry, how do you see that sort of scale coming together?

Tom Greatrex: It is not a choice between the two. It is both/and, partly because there are sites that have been identified in the previous siting process as suitable for large-scale nuclear. There are other nuclear-licensed sites around the country that would not be suitable for large scale but may well be suitable for small scale.

When you think about the overall requirement for electricity capacity, not just to decarbonise the grid but to get to net zero, whichever way you do it, to produce green hydrogen through electrolysis from zero-emissions power you are going to need a lot of electricity capacity, of which nuclear will be an element. The scale of what we require does not mean that you need to make a choice between large and small.

In relation to large scale, we have one power station, or two units, under construction at the moment. The likely next decision will be on what effectively is a copy of that, to be built at Sizewell, potentially. That is under discussion. There are potential other large-scale sites, as well as small modular reactors, such as the Rolls-Royce consortium.

Baroness Kramer: Mr Samson, does the costing that you gave us include the cost of waste disposal?

Tom Samson: Yes, it includes the element for the funded decommissioning plan, which is a component of the LCOE calculation in the UK.

Baroness Kramer: It is not the total cost, though. It is just that element of it.

Tom Samson: It is the funded decommissioning plan to prepare the long-term disposition of the spent fuel and to return the site to its original condition.

Lord Fox: Could you just very quickly reiterate the numbers that you gave us and the comparison of the cost of generation with what we are seeing from, I guess, wind? I know that you would factor in the firming of

that wind somewhere, but just give us your numbers again.

Tom Samson: The two numbers I gave you were a comparison between a RAB-funded nuclear programme, which is £40 to £50 per megawatt hour, and a programme funded by traditional debt and equity, which is about £60 to £75, depending on the cost of capital. Keep in mind that the first unit's costs are higher, which is the top end of that range. As we build more in the factory production environment, we will get the nth-of-a-kind benefits, and we will see that learning and cost reduction flow into subsequent units. You will see the costs come down from the first units to the nth-of-a-kind unit.

Whether that is between £40 and £70 per megawatt hour for a variety of forms of financed nuclear, if you look beyond 2030 to renewable plus storage, factor in whatever projections you make on the reductions in cost for nuclear and for battery, and try to recreate an equivalent firm power analysis to do an apples-for-apples comparison, it is very hard to come up with a number that is less than £100 per megawatt hour for a firm renewable source of power beyond 2030.

Baroness Noakes: Can I just clarify that the figures you gave us are for the first build?

Tom Samson: I have given you a range of figures to reflect the start point, the end point and the range in the cost of capital.

Baroness Noakes: To what extent does the cost of capital contribute to the differences?

Tom Samson: It is a significant difference. The cost of capital difference between the RAB and a traditional funded debt and equity model could be a delta of as much as £25 to £30 per megawatt hour.

Lord Stern of Brentford: Can I just check? You said £100 for renewables.

Tom Samson: No, renewable plus battery storage to create a firm equivalent power to compare nuclear baseload with an alternative renewable form of baseload that was available 24/7.

Lord Stern of Brentford: You are talking about that for 2030.

Tom Samson: It is beyond 2030. You have to factor in the cost of renewable capacity, the cost of battery storage and the excess renewable capacity to then store the energy in the batteries to keep it available for when there is no wind.

Lord Stern of Brentford: Are you sure those numbers will be shared by other analysts?

Tom Samson: Again, I referred to a number, and it is hard to find evidence that that number will be below £100 per megawatt hour. Much of the data and evidence is for much higher numbers than that.

The Chair: It would be very useful if we could ask you and the Nuclear Industry Association to write to us with the numbers, because they will be critical here.

Tom Samson: We are not in the business of projecting the costs of renewable plus storage, but we point to data that exists elsewhere.

The Chair: No, but certainly in terms of your own costs, maybe we can ask for a couple of assumptions on what that cost would come to. Clearly the renewable industry will also have a view about its own costs, but whatever we can understand from you would be very useful.

Lord Stern of Brentford: In making your reply, could you have a look at the work of the Energy Transitions Commission?

Tom Samson: Do not get me wrong: the marginal cost of renewables is a different, much lower number. That is not an apples-to-apples comparison with the nuclear baseload.

Lord Stern of Brentford: I think I get the difference between average and marginal. Thank you.

Q169 **Viscount Chandos:** Mr Greatrex, you said it is not a case of either/or, but given Mr Samson's figures as to what small modular reactors could get down to, in terms of cost of output, can large-scale reactors feasibly match that?

Tom Greatrex: They can certainly get down to a much lower figure using the regulated asset base model, which you have just legislated for and which got Royal Assent last week. Using that model significantly reduces the cost of capital whether you are building large or small.

The figures that get cited in relation to Hinkley Point C, for example, are not a guide to what every large-scale project will be, because if you are using a different financing mechanism you significantly reduce the cost of capital. When you talk to EDF and others about their range of figures, I think they are around about £60 per megawatt hour. It is that type of figure, and potentially lower. The more you do, the more you are able to reduce that if you use the same reactor design, the same equipment that has been qualified and, quite often, elements of the same supply chain. All those things can contribute to a reduction in cost.

Viscount Chandos: If I suggested that the sites for the power stations that are being decommissioned might best be used to host multiple SMRs, given the sensitivity about brand-new site planning, what would your view on that be?

Tom Greatrex: There are a number of nuclear-licensed sites around the country that are not currently designated for new build but which could very well be suitable for SMR. The reality is that, certainly in the first few units, it is very unlikely that it would not be on a nuclear-licensed site, to be frank. Where might it otherwise be? You could have brownfield sites that have previously been used for other forms of energy generation and

production, which also might be suitable. But you are correct that the likelihood is that nuclear-licensed sites, where you have previous power stations in various states of decommissioning, could well be the best place, certainly initially.

Viscount Chandos: Mr Samson, you answered Lady Kramer's question on whether the cost of disposing of the nuclear waste safely had been built into your estimates, which you confirmed, but do you think that, in general, public concern about nuclear waste is low at the moment only because of the degree of focus on carbon emissions? What is the risk that, down the road, greater focus and concern arise about the waste?

Tom Samson: There is probably a growing realisation of the context in which nuclear waste and how it is regulated, managed and dealt with has been considered relative to the impacts of climate change and the emission of fossil fuels over the last many decades. In context, that is a product of a form of generation that is highly regulated, controlled, managed and costed into its complete energy cycle, which is not the case for any other form of energy.

Those communities that, as Tom mentioned, have hosted a nuclear asset for the last five or six decades and lived next to a generating asset and its waste streams are very comfortable and familiar with what that technology means, its safety and the economic benefits that come from having a nuclear power plant there. They are the strongest advocates in this country for bringing nuclear power into those communities. That also puts a lot of context around the familiarisation and the relative safety risks associated with nuclear power, given that those are the communities that are most supportive.

Viscount Chandos: That is, until there is a problem.

Tom Greatrex: Most nuclear waste is completely benign; it is steam. The high-level waste that people have a concern about, for the entirety of all the nuclear energy ever produced in the UK, which is the equivalent of 30 years of everybody's demand, is about the size of a dishwasher tablet. The volume of what you are dealing with is comparatively very small. It is something we have dealt with and continue to deal with in the way it is stored and managed. As Tom said, that does not happen with any other energy source. The worst impact is that of greenhouse gases.

You also have waste from other forms of technology—what is in batteries and spent solar panels, for example. Some of that is not stored, frankly; I think it is thrown mostly in landfill, and that can have an environmental impact. You have to see that in the round when you explain and help people understand the reality as opposed to the perceptions.

Q170 **Baroness Noakes:** We are waiting for the Government to set out their energy policy, but the current intention is to have 25% of nuclear. Mr Greatrex, do you think the regulated asset base set out in the Act that we referenced earlier is sufficient to get that amount of nuclear financed?

Tom Greatrex: It is a very important part of being able to move with some pace in getting nuclear developed. The issue we have had over recent years beyond Hinkley has been a number of projects that have not got to fruition because of the cost of capital and financing issues. The RAB model helps solve this, but it is not sufficient on its own. There also needs to be clarity, which we hope we will get this week from government, not just ambition, as Tom said. We can make lots of different models about how much nuclear you might want in a future mix.

The Prime Minister, last week or the week before, in the round table referred to 25% by 2050 and talked about 15 to 16 gigawatts by 2035, which is the grid decarbonisation target, and beyond that for 2050, which is the net-zero target. For the industry to deliver that, we are looking for clarity about how much is wanted, because then the investment in the supply chain, ensuring we have the people with the right skills to deliver it, can happen. If we have a vague comment about how it would be quite nice to have some more, the RAB model alone will not solve that issue.

Baroness Noakes: Is the RAB model integral to the success of small modular reactors?

Tom Samson: We welcome the fact that the Bill has passed and that the Nuclear Energy (Financing) Act is technology agnostic. It is there for nuclear to help address the financing challenges, and it is a great step. To your earlier question to Tom about whether it is enough: no, not on its own. There is a set of criteria to enter the RAB, which, for many developers, creates this period that requires significant investment, but without the certainty that you can enter the RAB model it becomes very difficult to raise the capital to progress through those stages. We will be looking to bring in solutions that can help bridge that, but there will need to be some assurances that we can then access the RAB.

We are also looking at other mechanisms. We are talking to customers, because the scale and capital costs in a single SMR could be digested by industrials and companies that wanted to put them on the balance sheet, providing them with 60 years of clean power beyond 2030 to power data centres and produce hydrogen. There are other avenues to market for us, but they may take longer to mature than our ability to access the RAB.

Q171 **Baroness Kramer:** I wanted to quickly ask you about the RAB and its consequences, because it is not a cost-free option, is it? It reduces the cost of capital dramatically for you, but it puts that cost on to consumers. I happen to live on the route of the Thames Tideway tunnel, where I think our water bills have gone up £80 per year to deal with the RAB for building the tunnel. What kind of add-on would you expect to consumer bills in order to provide you with the low-cost financing that makes the economics work?

Tom Samson: Whatever solution is implemented to deliver clean energy, there is a cost and the consumer has to pay, either in their power tariff or in their taxpayer tariff. It has to be paid for somewhere. The benefit of the RAB model is twofold. It allows the cost of capital to be reduced by

the introduction of a lower-risk approach for equity and debt, based on the strength of the government support package, and allows the consumers to fund the build during the construction phase, so you are not having to finance interest to the consumer during construction. The ultimate cost to the consumer relative to another funding model is lower. The consumer does benefit from a RAB model.

Q172 Lord King of Lothbury: I wanted to follow up on this, because Baroness Kramer has pointed out that going to the RAB model essentially is a way of getting a subsidy from outside your estimates of costs to make it appear cheaper. If that is all it is, surely the right estimate of the cost is the one you gave before, in the £70s, not the lower cost. That is the true cost. Who bears that is a matter to be decided.

You make a good case for the benefits of smaller reactors sharing the risk and so on, but what I find slightly odd is the idea that, somehow, such a large chunk of costs can be accounted for by smoke and mirrors or waving of hands around cost of finance. If the capital markets cannot finance this for less than, say, £70-odd, the idea that Governments can produce some magical solution and formula that lowers the true cost cannot possibly be right.

Tom Samson: That is a tough question to answer from a former Governor of the Bank of England, so I will try my best, as a non-banker, to address it. The factors involved in the funding models around the RAB are around how the cost of capital is reduced by the introduction of government support packages. That is the difference. If I was to finance an SMR from the market and use traditional debt and equity there would be a higher cost of capital.

Lord King of Lothbury: I understand the problem in financing a very long-term project with a lot of risk, but the difficulty here is that that risk is real. Whether it is in the form of risk to private suppliers of capital, given the uncertainties about the market, or whether they hope that the Government will somehow pick up that risk but charge someone else for it does not alter the underlying cost to society of investing in a risky, long-term project.

Tom Samson: Let me answer that by maybe addressing how we have designed our SMR to be different. It is a radically different way to build a nuclear power plant than has been done in the past.

The Chair: As you do, it would be useful if you can mention where we are in the development process. Do we have a prototype and at what scale? Give us a sense of where we are in the development process.

Tom Samson: Rolls-Royce began designing this solution around 2015, in response to the fact that we did not have a domestic nuclear solution in the UK. We had to start with a blank sheet of paper, but with about six decades of manufacturing and designing nuclear reactor technology for the submarine fleet. That was the heritage that we started with to design this civil application.

We have designed a solution that addressed a number of market-based conditions and was low cost to the consumer. We are using standard pressurised water reactor technology and standard fuel to keep the cost down, and we are using a size of facility—500 megawatts—that allows us to buy many of the products that exist in the market today.

We also designed something to be deployable with greater confidence, to minimise that completion risk and the construction delays by driving as much of the activity as possible into a factory environment—90% of what we have designed is conducted in a factory environment, including the work on-site, which is done in a site factory. That helps us maximise productivity and use modern methods of manufacture, enabling us to create schedules that we can deliver with greater confidence.

The other factor that we designed for was to make a product that is global and scalable. This is not just about the UK but about providing a product on the world stage to help in the clean energy transition.

Finally, the fourth point was to make a product that was investable by private capital, by providing a turnkey market solution where we, as Rolls-Royce SMR, take the full responsibility for delivering, under a single contract, a fully integrated 500 megawatt nuclear power plant. We believe that turnkey approach with the other features makes us a very much more bankable and investable proposition from a risk perspective.

Those are the design features in our SMR. To your question about the design maturity, we secured £490 million at the end of last year, £210 million from UKRI grant funding and £280 million of equity from new shareholders, including Rolls-Royce. We have now brought in Constellation Energy, the largest fleet operator of nuclear assets in the US market, previously known as Exelon; QIA, the Qatari sovereign wealth fund; and BNF, part of the Perenco oil and gas family. Bringing in these new shareholders allows us to take the design through the UK GDA process, with the nuclear and environmental regulators.

We are starting that process now. We have doubled the company's size in the last four months. We are now over 360, with 160 coming from Rolls-Royce into the new company in November, and we expect to be above 750 by the end of the year. We are growing the engineering team and we are taking the technology through the UK regulatory process now. We expect that process to be complete by 2025-26. In parallel to that GDA process, our goal now is to find sites that can host the technology and secure orders so we can begin manufacturing and building the factories that will produce the content here in the UK.

Lord King of Lothbury: The challenge for you is to get Governments to give regulatory approval to get over the issues surrounding regulation, rather than financing, because what you describe sounds eminently financeable.

Tom Samson: We are fully committed to the GDA process. It is the first time in the ONR's history that the GDA has been processed by a British

technology company through the UK regulator. We are designing it concurrent to that process. We are not trying to fit a foreign design into the UK landscape. We have every confidence that we will be able to successfully complete that very rigorous process with the ONR and the Environment Agency. We already have money in place to take us through that process.

The challenges we have now, which we hope will be addressed in the energy security paper, are how we identify sites within the existing nuclear estate where this technology can be determined to be deployed by government, so that we can work on securing the orders that will allow us, in parallel to preparing the sites, to begin building the factories to manufacture the technology.

Lord Fox: Are you going straight from that regulator/GDA experience to production, without building prototypes in between? That is one question. Secondly, does the fuel of these civil reactors differ from the fuel in the nuclear subs?

Tom Samson: The answers to those questions are linked, in the sense that we do not need a prototype. This is a standard pressurised water reactor, the most commonly used nuclear reactor in the world today. That is what has been operating at Sizewell B. About 50% of the world's nuclear reactors are pressurised water reactors. We are using a pressurised water reactor with standard fuel, an existing design that is very well developed. There is no innovation in the nuclear technology part. The innovation is in how we modularise this nuclear power plant, how we build it in a factory, and how we modularise and digitise the whole process.

Lord Fox: We get that. So it is not the same fuel as you have in a submarine, or is it?

Tom Samson: It is not.

Lord Fox: The allusion to submarines is merely the fact that they are smaller, because they are different reactors from the ones that you will actually be producing.

Tom Samson: It is a similar family of nuclear reactor. Again, I cannot get into too much detail on what our submarine technology is, other than to say that our pressurised water reactor is part of a family of pressurised water reactors that already exist, whose design has been proven for the last 50 to 60 years. That is a proven form of nuclear technology that does not require a prototype.

Q173 **Lord Stern of Brentford:** I wanted to ask you about the challenges of getting decisions and getting things done, but just to check I understand the numbers, we heard from Lord Turner that we might need, ballpark, double the electricity capacity by 2050. We have 75 gigawatts now, ballpark, so double that to 150. I know there is a difference between the capacity and the flow of kilowatt hours, but from what you are saying,

25% would be somewhere between 30 and 40 gigawatts. At half a gigawatt per go, that would imply quite a lot, if much of it was to come from SMRs. I just want to be clear and roughly get the numbers right.

Tom Samson: Your maths is right and, as Tom said, we are not advocating that the only solution deployed in the UK is a Rolls-Royce SMR. We see a challenge of enough scale that we should be doing all of the above, so large projects are already under way. We can certainly respond with large volumes of SMRs between now and 2050 as part of that response to the challenge of 2050 nuclear capacity, but we also intend to build more units than that because we intend to export them globally.

Our model also involves us building regional hubs in other parts of the world to produce product in those market territories for demand in those regions. Eventually we could have a licensing model, where the licence could be sold to other parts of the world where they can manufacture their own product.

The Chair: Can I just come in on the export: are UK regulations consistent enough with other countries that, basically, if you get approved here it is fine and it is cost effective? We have seen in the defence industry, where UK specifications are so advanced, that value for money falls down. Is it actually exportable?

Tom Samson: It is absolutely exportable. We have to promote this concept of international regulatory harmonisation. It is something that we are working with the IAEA to promote and that many countries are looking to embrace. We are in a fortunate position that the UK regulatory landscape probably is a high watermark for nuclear regulatory standards globally. If we can progress through the standards in the UK we will be in a good place to convince other nations to embrace that regulatory standard, especially newcomer countries, and to help them progress through their own regulatory regimes in the context of what has been regulated in the UK. We are very keen to promote international regulatory harmonisation, but each country has its own sovereign duty to regulate its own technology applications, so we have to follow and go through those processes.

Lord Stern of Brentford: We have heard from a number of witnesses, on renewable and now nuclear, that a big part of the problem is getting permission to go ahead. It might take you four times as long to get permission for a wind farm as it takes to build the wind farm, and obviously this applies to nuclear as well. You made that point very clearly at the beginning.

What do you want to get out of the way? How do you get those permissions through in a period of time that might be acceptable, in terms of democratic governance issues and relations with local communities? How would you actually go about overcoming that in a way that might be acceptable?

Tom Greatrex: I think Tom may have alluded to this point before. In the past we have gone through a series of processes one after the other, but there is no reason why they need to be done one after the other. For example, the GDA process is about the design of the reactor and the integrity of that design, which the Office for Nuclear Regulation assesses. There is no reason why you have to wait for that to complete or get near to completion before you do a siting process for SMR, for example. Those things could happen together. That would then decrease the amount of time you spend before you start construction.

The development consent process is something that, as I am sure you would have heard from the renewables industry as well as from us, has caused issues. Some of that is because the sense of urgency that a number of people feel about net zero, making the transition and reducing our reliance on fossil fuels for environmental and economic reason is not always shared in the regulatory processes, hence the time taken. Something as relatively simple as a net-zero duty, for example, could have an impact on changing that mindset, to be more about the urgency of getting to that point.

Lord Stern of Brentford: Do you mean a net-zero duty in the regulator?

Tom Greatrex: Yes. It does not mean you are cutting out the integrity of the process, but you are moving more quickly with it because there is an understanding about where you need to get to and how quickly you need to get there. That sense of urgency has been missing over the past few years and it is now starting to become a bit more apparent. It is those types of areas where, by doing the things we still have to do but a bit smarter, you can make a difference in the timescale to deployment.

Lord Stern of Brentford: Can Ofgem deal with planning issues?

Tom Greatrex: No, I do not think Ofgem would be in a position to deal with planning issues.

Lord Stern of Brentford: That is a big part of the delay, right?

Tom Greatrex: It can be; it does not necessarily have to be. Again, when you do a siting process, if you identify the likely sites where you would make an application, often that process could deal with a number of the issues that would rule you out, in terms of planning. The siting process could be more significant. From there, as Tom said and as I have alluded to, a number of the places where you are likely to want to build are places where there is strong community support. That can also help that process, so you are not necessarily dealing with a situation where it is completely new to a community, and the community therefore does not have a sense of support and momentum for wanting to see those projects go forward.

Lord Stern of Brentford: Other Tom, can you help with that, including on the siting process? We understood that the big nuclear reactors really need to be near coastlines. Is that the same for SMRs?

Tom Samson: No. Partly because of the environmental impact of extracting larger volumes of seawater or coastal water, we have made a strategic decision to make our base design using modern, mechanical draught cooling towers. That allows us to minimise the need to extract water from the sea or the seashore, and it allows us to then be on rivers or lakes to maximise the flexibility of where we can put our smaller SMRs. That is an added benefit. Part of that was driven by the scale and complexity of securing environmental permits to extract or to disrupt the seabed in order to bring in cooling water.

Lord Stern of Brentford: You would need a river or a lake, would you?

Tom Samson: You would need some form of water cooling, yes, for a smaller percentage of water than you would if you were doing it by seawater cooling alone. Importantly, you asked what could be done differently or what could be removed. Within the UK, or at least within England and Wales, the Nuclear Decommissioning Authority estate has most of the existing nuclear assets that have reached the end of their life and their locations are ideally suited for this size of technology. We already have dozens of locations where we could consider deploying this technology on sites that already have a grid connection, water access and a supportive local community.

The question is what length of public consultation and planning permission should apply in those locations to decide to build a SMR. We should absolutely consult the local communities and it absolutely should be tied into the Government's strategic ambition to deliver gigawatts by a certain date, but within that context it really does not justify a five-year planning process to consult extensively over an extended period to put a nuclear power plant where there has been a nuclear power plant for the last 60 years. That is the opportunity to then intervene, in a way, with this new technology and look back at those sites and the planning decisions to enable us to move at pace.

The importance of this, not only for security of supply but back to my earlier point about the cost to the consumer, is that by introducing larger volumes of renewables into the grid, which is a great thing to do and we support it, the cost to the consumer is higher without nuclear. By bringing nuclear into the grid, the cost to the consumer is lower. We are benefiting the consumer in the long run by bringing nuclear power on the grid earlier, and we are in turn not only meeting our net-zero objectives but strengthening our energy independence.

Lord Stern of Brentford: I have one last question on this permissions story. You mentioned you could be up and running and producing electricity from the SMRs by 2029 if permissions came through quickly enough. How quickly do you need the permissions to produce them by 2029?

Tom Samson: The assumption we made in the letter I wrote to the Prime Minister last week was that if we are given the green light with a commitment and an order to proceed in the coming months, and we then

produce, manufacture and deliver the product to site, then before we come to the site the consultation will have taken place and the decision to allow us to build will have already happened so it is no longer on the critical path.

Q174 **Lord Skidelsky:** Perhaps Mr Greatrex could start, because this is a general question. What are the advantages of having nuclear as part of the energy mix? Do we take a different view from Germany?

Tom Greatrex: In policy terms, we take a very different view from Germany.

Lord Skidelsky: Why is that?

Tom Greatrex: There is an interesting question around German politics and a range of issues but the reality is that there has been a massive expansion of renewable capacity in Germany but carbon emissions have not significantly reduced in that period. What has ended up happening is that, at times when you require other ways to deliver power because of the variability, that has been done by burning lignite, which is probably the dirtiest form of coal you can use, to power German industry. Other issues in Germany around the grid connections between north and south have also impacted on that.

It has been the view of successive UK Governments that nuclear should be part of the mix because it provides secure and reliable low-carbon energy, with no emissions during generation, over a very long time. Once you have built a nuclear power station it produces a lot of electricity from a small footprint for a very long time. That is a useful thing to have, both for grid resilience and to minimise the amount of fossil fuels that you use either to generate electricity or for other applications. That is the difference.

Increasingly, even in Germany, you will find that people are starting to question the wisdom of the German policy because of current events and the impact of the reliance on gas from Russia, for example. Then the alternative is even worse than gas, which is different forms of coal. A view that you could get to 100% renewables is not realistic; I have not seen a credible assessment or analysis that shows you can do it with just renewables. My colleagues at RenewableUK would say the same thing. We might have different debates about the exact proportions, but you need both of those types of low-carbon generation to get to a grid decarbonisation target in 2035 and a net-zero target in 2050.

Lord Skidelsky: You are trying to build nuclear energy capacity against a background of widespread popular opposition to nuclear, which has manifested in various ways. Whatever it is, whether it is Chernobyl or the association with nuclear weapons, there is opposition, which is independent of locality. It may be irrational, but it is there, is it not?

Tom Greatrex: I do not necessarily think it is there to the extent that it is perceived to be there. We have done polling. There was polling done late last year asking whether nuclear should be part of the mix alongside

renewables. Broadly speaking, you get about 70% support for that. There is majority support in the UK.

Lord Skidelsky: Is that because they understand that you are talking about small nuclear?

Tom Greatrex: No. Some of this predates the surge in prices, although the price increases in electricity started to happen last summer; it was before the biggest surge. At that point, especially around the time of COP 26, there was a recognition of what you need to do to get to net zero. Increasingly, and significantly in more recent weeks and months, it has been about a concern about the impact of not having much energy security and resilience in your system. You can see that in the bills that people are going to have to pay and the impacts that it has on the underlying economic conditions that people are living in.

Lord Skidelsky: Do you think people are as reassured by having nuclear energy as part of the energy mix as they are by having wind or solar energy?

Tom Greatrex: They do different things. Once you get to an understanding of what the different contributions can be, there is not necessarily a huge amount of difference. If you asked a very binary question, "Would you prefer wind or nuclear?", often people would say wind, but they would not say that if they were someone where there was planning for an onshore wind farm, for example. You have different views in different circumstances. Overall, once people are aware of the different elements that help to make up that mix, the broad view, from all the polling that I have seen over a sustained period, is that you need a mix, and nuclear can and should be part of that mix.

Lord Skidelsky: Mr Samson, would you agree with that?

Tom Samson: Yes. Consumers want low-cost, dependable, clean energy. They want to be able to have their power when they need it. They do not want it to be intermittent or interrupted based on weather. Therefore, we need a mix. You cannot get there entirely with renewables because it is an intermittent source of energy. Nuclear has a really important role to play. In fact, if you look around the world today, those economies that have relied most heavily on nuclear as a form of energy, whether it be France or Ontario in Canada, have some of the lowest and most resilient costs of energy to their customers. Customers are starting to realise that nuclear can play a really important role in keeping their costs low and providing them with secure, dependable and reliable sources of clean energy.

Q175 **The Chair:** Can we just come back to the RAB question? We are just a little confused. First of all, are you expecting to have a RAB model? We read previously that Rolls-Royce was actually interested in contracts for difference. Given the certainty of the technology you described, why are you pushing, if you are, for a RAB model rather than a contract for difference, a cap and floor or some other model that reduces pricing risk,

if you think you can build it and you know how much it is going to cost? I can understand that it is potentially different for large nuclear, but for SMRs can you give us a little more, because we are just a little puzzled?

Tom Samson: The puzzle is because we are flexible, adaptable and can respond to any of those opportunities. We want to work with the one that allows us to come to market most quickly. If that is the RAB, we will pursue the RAB. A huge amount of work has been done in this country to get the Nuclear Energy (Financing) Bill done. There is a huge amount of interest and appetite from financial institutions to invest in the RAB, and we believe we are a form of nuclear energy that could also benefit from the RAB.

At the same time, as I mentioned, we have designed this to be an investable proposition. That allows us to make ourselves attractive to other forms of capital, given the scale and the lower risk profile of a factory-built solution. We want to explore those avenues as well; particularly in other markets, they may well be the form of solutions that we adopt.

CfDs are a route as well in the UK, but they have the same challenge as the RAB that, until you can enter that contract environment, you have to fund the journey to get into that point. That is this developer challenge that has caused the failures at NuGeneration and Horizon, and we do not want to fall into that trap. We are trying to find a way.

The Chair: It was not actually unpredictability of costs. A bigger issue was the funding period in some of these things, whereas you are clearer. I absolutely get it for the big stuff. You talk about the timescale and unpredictability of costs, but I think you said to us, and correct me if I am wrong, "We know how to build this stuff. We've built it before. It's a variation upon it. We can deliver it. We know the timescale. We don't know exactly what the pricing environment will be, so that's the thing we need to sort". That is why I was wondering. You say you could work with either model, but you prefer the RAB, basically.

Tom Samson: Whichever one is available that we can progress with—we will pursue all options. The RAB seems to be available and has come about much more quickly than perhaps we anticipated, but equally, if the Government want us to focus on a CfD model we can do that as well.

The Chair: They have for offshore wind.

Tom Samson: Yes. It is a bankable solution and we believe, with the right levels of government support, we could contribute to that scheme as well. The Nuclear Energy (Financing) Act has been created to help reduce the cost of financing nuclear and, at the end of the day, an SMR is a nuclear power plant. That is allowing us then to afford those same benefits to consumers by pursuing the RAB model.

Q176 **Lord Rooker:** I have a minor declaration. In 1998-99, Tom Greatrex and I were working together in the Ministry of Agriculture, Fisheries and Food. That was a long time ago, but nevertheless it needs to be said.

The Chair: You all look too young.

Lord Rooker: I remember saying at the Second Reading of the Nuclear Energy (Financing) Bill that when I was on a trip to do with the tideway, going back at least four years, financiers would explain to me how the tunnel was being built. I do not do economics, but it seemed too good to be true. At some point, the consumer pays. There is no question about that. When Crossrail opens, my old constituency in Birmingham will probably end up paying for part of it, which does not seem quite right. I can understand why there is that.

In parts of this country, there is a religious fervour against nuclear, and you have to take cognisance of that. I saw a reference recently to small modular reactors, and I do not think it said "in towns and cities", but it sent the wrong signal, from my point of view. As you clearly said, there are nuclear-licensed sites around the country and you need a lot of water.

My question was about an issue we have not touched on, which is the security. It used to be said that we had the only privately armed police force in the country—the UK Atomic Energy Authority Constabulary, which is pretty vital. Are there concerns about the risks of cyberattacks on nuclear power, and of hostile or unfriendly countries owning nuclear power plants in the UK? How do these risks get managed to the satisfaction of the UK public? I probably should say "England and Wales", because I suspect there will not be any of these in Scotland.

Tom Greatrex: It is very good to see you again. The process of the generic design assessment for any reactor design, whichever entity it starts from, is very rigorous on security, including cybersecurity. In terms of physical security and what is built into the design of reactors to prevent the impact of a terrorist attack and those types of things that are often cited, there is a high degree of confidence in the integrity of that regulatory process to address those types of issues.

These issues, as you have alluded to, are often cited by people who are concerned or ambivalent about it, and it is a process of being able to explain what protections are in place and why they are in place, more than there being an issue where there is a gap, as such. I think it is all covered, but we need to help people understand that.

Going back to a point Tom made earlier about communities where there have been nuclear facilities in the past, there are lots of places where people want them to be in the future. I can think of a handful of places that are clamouring for there to be the first SMR or an early SMR in their community and on their site. They understand all of that because they have been part of it and lived with it over generations, and the difference between the reality and the perception is very acute in their minds.

Tom Samson: I echo what Tom has said. Going back to the design, the regulatory environment and the defence and depth that we have built into our technologies, security and safety features are inherently built

into everything we do. We have a very robust regime in the UK, not just in how we design these plants, both for physical and cybersecurity, but with a regulatory environment and other elements that we can call upon to ensure that those assets are properly protected as part of the national infrastructure.

Lord Rooker: That is why you do not expect to see them in urban areas.

Tom Samson: There is a misconception around an SMR at the bottom of every street. These are industrial power plants that will be located where there have previously been coal-fired power plants or industrial refineries. In terms of using this technology to produce hydrogen or synthetic fuel, these are industrial-scale solutions that will fit into the existing industrial footprint in England and Wales, and maybe one day Scotland.

Lord Rooker: If I could make just one final point, which was raised earlier: nobody is envisaging our electricity supply to be 100% from renewables. Lord Turner said earlier that the figure was 70%. What is the alternative to nuclear for what used to be called the baseload?

Tom Greatrex: In terms of there being capacity that is low carbon or compatible with net zero, there is none. When the Committee on Climate Change did its assessment of getting to net zero by 2050 it talked about firm power, which is not quite the same as baseload but means, in shorthand, a similar thing—that which is not impacted by the weather—as being 38% of the future power mix. That does not necessarily mean that is all nuclear, but you would need a chunk of that to be something that delivers low-carbon electricity at scale continuously to complement the different sources and the variability.

That variability has actually fed into the situation we are in at the moment. It may seem a long time ago now, but last July, unusually, was not very windy at all and we were burning coal for most of July, even though, in other months, we had been talking about how we had not burned any coal for a long time.

The variability is real. You can forecast the weather and predict it to a certain extent, but you cannot control it in that way. Those are some of the challenges in managing the grid, which is why the Committee on Climate Change, as with any serious assessment that I have seen, suggests you need firm power as part of your mix to get to that net-zero future.

Q177 **Lord Fox:** I have a question, for the avoidance of doubt, but I think you answered it when you told me that it is a different fuel from the submarines to the civil use. What, if any, are the nuclear proliferation risks of exporting this technology?

Tom Samson: Any country receiving this technology would have to be signed up to all the appropriate international treaties through the IAEA. There would be appropriate export controls in place. There is existing legislation that already deals with the transfer of nuclear material,

knowledge and non-proliferation, which are all preconditions for us operating in any market.

Can I make one final point on the back of the previous question? It is not just about grid electricity. The need to decarbonise off grid and to produce heat, transport fuels and industrial applications will require even more energy. Our technology also offers itself to be an adaptable form of clean energy that can produce hydrogen, synthetic fuel and industrial heat, or power data centres. There is a whole range of areas requiring harder-to-decarbonise solutions that we can also contribute to.

Q178 Baroness Kramer: Can you provide us with anything to understand this financing model? I have to confess that I am quite troubled with the idea that a large part of your financing will come from requiring the poorest people in the country to pay an additional amount on top of their energy bills, with no interest return for the time value of money or for the risk they are taking, when, frankly, if you had offered them the choice of that investment they would not have accepted it. I am quite troubled by that aspect being apparently key to making you price competitive against other forms of clean energy.

Tom Greatrex: You should be troubled by the fact that the poorest people in the country are now paying electricity bills through a marginal cost of electricity that is four times higher, as a result of not investing in low-carbon infrastructure and the mix that you need to get towards a much lower reliance on fossil fuels. That is the root of the problem, and that is what is impacting on the bills of everybody in the country and on the underlying economy.

Baroness Kramer: We understand what you are saying, but as we have to make choices, we have to be able to compare like with like. I am quite troubled when the cost that is transferred to the consumer is somehow taken out of the presentation of the cost of the product.

Tom Greatrex: I do not believe that it is, actually.

The Chair: We are going to get something on relative cost per kilowatt and the assumptions underlying that, so we can take that on. Can I just say to both Toms thank you very much indeed for coming? You have been very helpful and it is appreciated.