



HOUSE OF LORDS

Science and Technology Committee

Corrected oral evidence: Long-duration energy storage

Tuesday 30 April 2024

10.10 am

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Members present: Baroness Brown of Cambridge (Chair); Lord Berkeley; Lord Borwick; Lord Drayson; Lord Lucas; Baroness Neuberger; Baroness Neville-Jones; Baroness Northover; Lord Rees of Ludlow; Viscount Stansgate; Lord Strasburger; Lord Wei; Baroness Willis of Summertown; Baroness Young of Old Scone.

Evidence Session No. 13

Heard in Public

Questions 126 – 142

Witnesses

I: Adam Bell, Director of Policy, Stonehaven; Dr David Joffe, Project Director, Royal Academy of Engineering.

USE OF THE TRANSCRIPT

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

Examination of witnesses

Adam Bell and Dr David Joffe.

Q126 **The Chair:** I would like to welcome the witnesses to the committee's follow-up session in its inquiry into long-duration energy storage. Our two witnesses this morning are Adam Bell, the director of policy at Stonehaven, and David Joffe, director of the delivery of the rapid electricity systems decarbonisation project at the Royal Academy of Engineering. The session is being broadcast on parliamentlive.tv, and a full transcript will be made available to you shortly after the meeting for you to make minor corrections. If you think of anything that might be helpful to us that you did not get a chance to say or data that might be useful, let us have that after the session as evidence. That would be very helpful. We would be particularly grateful if you could do that quickly, because we are seeing the Minister next week. It will be helpful in forming our questions to the Minister and it would be good to have it as soon as possible.

I will ask the first question. What role do you both see long-duration energy storage playing ideally in a decarbonised grid, and do you think that the current government policy on this is coherent and sufficient to bring long-duration energy storage forward?

Adam Bell: The role I see for long-duration energy storage, which for convenience I will refer to as LDES from here on, is effectively almost as a replacement for a lot of the functionality that gas currently has in the system. In technical terms, this is what is known as a mid-merit role. The role is not to provide peaking power in the morning or evening, when demand is highest; it is to infill the gaps during the day, and to an extent at night, when solar output and wind output might be lower. So it will be operating for a number of hours, providing power throughout the day.

This is an interesting and complex role. Currently, it is provided almost entirely by gas using combined-cycle turbines. However, for LDES to fulfil this role, you need a system whereby market participants are incentivised to provide that sort of service to the grid. The Government's current mechanism for doing so, the cap and floor, is intended effectively just to find a floor for revenue rather than to incentivise one to act in a particular way. This is very challenging, inasmuch as you have a lot of assets coming on to the system now that handle peaks, in the form of batteries, but you have no way in which to distinguish between assets that are managing peak load and those that are intended to manage that mid-merit throughout-the-day load.

This means that LDES will be competing with other assets that are intended to do other things for the same sort of volume of power, so it will not necessarily be dispatching as efficiently as it might, if you think about it as just replacing gas. As a result, and because the Government are currently trying to incentivise LDES in two separate ways, there is a degree of incoherence. It does not necessarily all add up.

Just to get into that a little, through the REMA process government is splitting the capacity market into different chunks intended to do different things. We will come on to the gas component later. There will be an LDES chunk that is intended to provide a long contract for the sorts of services that LDES can provide. At the same time, the Government are also offering a cap and floor mechanism to many of these assets, which means that they will also have revenue protection for a contract that they will get from elsewhere, also issued by the Government. Effectively two mechanisms are trying to do the same thing, and it is not clear why that is or how the Government expect them all to combine efficiently.

The Chair: Thank you. I think I am more confused than I was before we started.

Adam Bell: Apologies.

The Chair: It is not your fault at all.

Dr David Joffe: To add to what Adam said, part of the value is that if we want to fully decarbonise the electricity system, we will have to push out gas in the roles that Adam talked about and fill in during periods, particularly of low wind generation and so on. But the other value of LDES is in energy security and having energy stored in case we need it, which in the long term will be in the form of hydrogen, I should imagine.

In thinking about the services that LDES provides to the system, that is a good way in which to think about how we need to reward it through mechanisms. One thing that long-duration energy storage will be able to do is to buy power cheaply and sell it expensively once it has gone through the store. So there is a certain amount of arbitrage opportunity there, which can be factored into the business models.

More challenging is having a business model that rewards that long-term energy security role whereby you might be storing hydrogen to be used once in a blue moon. It is of real value to the country; it is just that you are not using it very often. So how do you create a revenue model around that? So LDES provides

different services, and it is important to consider those when thinking about how to incentivise it.

There is also the cap and floor approach to incentivising something like hydrogen, which might cycle infrequently—coming in and going out relatively few times—across the year. The floor may well be the most important thing there, whereby you are setting a range for allowed revenues, but you may never hit the top and may always be pretty close to the bottom. That is fine, but that suggests that what that mechanism is trying to do in bringing forward something like hydrogen storage might not be the most valuable thing. Other forms of LDES may have different characteristics.

Q127 Lord Lucas: How many of the reforms announced in the review of electricity market arrangements affect the Government's policy towards long-duration energy storage? We asked the Government to set out in more detail how they intend to provide low-carbon flexibility. Do you have a sense that they know which technologies will contribute to this and what the mix will be on a decarbonised grid by 2035? Given that the remit is not to be implemented until mid-2025, how much of a risk is there that major decisions in the public and private sector are pushed until after the general election and further delayed?

Dr David Joffe: My overall sense of the REMA consultation specifically is that it is very focused on operational signals in the electricity system in the 2030s. It is much less focused on what I am interested in at the moment, frankly, which is building the stuff that we need to have on the system for it to be operational. It is much more focused on the operational side than on how to get this stuff built. Some of the other consultations fill in some of those things.

It is not clear what the right set of long-duration storage technologies is for 2035. There is a broad consensus that hydrogen is part of the story for that, but it is relatively unclear what role other technologies should be playing, because some of them are quite immature solutions at the moment. An appropriate thing for the Government to do—they have not explicitly said this, but one could interpret their current approach—would be to support a portfolio of long-duration storage solutions alongside hydrogen. I do not think they have been as explicit as they might have been about the role of hydrogen. That is a gap.

Decisions being delayed until post the election is an issue for a whole range of technologies. One can only hope that the progress that has been made in getting these consultations out, and so on—there has been lots of policy progress, although it may have been

slower than one would like—comes to its natural conclusion rather than being halted by the politics of an election, but of course that is a risk.

Adam Bell: The Government's current approach is to buy a basket of technologies across hydrogen and LDES and hope that the wholesale market will somehow make all these things hang together. The operational signals that David referred to are part of this, but they are not sufficient to provide a complete explanation for how the Government see the market working over the next decade. That part is worrying. I would like the Government to have a better grasp of market dynamics here and an understanding of what role each one of these technologies will play at particular points during the day, what sort of demand it can expect to serve, how it will relate to things like demand-side response, and how all these things will interlock in what is in effect the Government's ideal version of the market.

Alongside that, there are a couple of other points that I would like to highlight. There are some challenges for the specific reforms in the REMA consultation around the capacity market, in particular for LDES. Currently, the capacity market buys enough capacity to ensure that the lights will stay on, essentially. The Government have realised that, because of the way in which the market is structured, just doing that is not enough to ensure capacity adequacy throughout the year.

Say you have bought a lot of short-run storage assets plus some longer-term storage assets of about eight hours. If there is an extended period of no wind and no sun, you will need to buy something else to fill the gap. The Government are structuring this by taking their existing capacity market and saying, "Okay, for this bit of it, we want to buy enough kinds of things that can run for about, say, 14 hours without interruption". That is, in effect, buying gas. We are also going to buy LDES through a mechanism that says, "We want to buy something that can store energy for up to eight to 12 hours".

Together, they provide different signals for different sorts of flexibility and respond to different sorts of system needs. This makes sense up to a point, because right now there is a lot of liquidity in the capacity market forcing down prices. The Government's new approach forces up prices by carving it up into little chunks. It means that, ultimately, you end up paying more overall for your overall volume of capacity, especially for gas. I expect the Government to probably pay over the odds as opposed to something more like a strategic reserve model, because in effect

what you are doing via that is relying on the private sector to take on the risk that it will be able to run those assets enough to make money in a new world, which it has specifically said it cannot do.

So there are lots of challenges arising from that. Frankly, I cannot see REMA coming up before the election. The challenge for the operational signal points that David just set out, of course, is that you could not bring in that sort of reform while still having a plausible pathway to deliver, say, Labour's 2030 targets. It is simply too much of a risk for investors.

Q128 Lord Lucas: Have we abandoned trying to store energy as methane, given the huge investment we have in methane distribution? I do not see any trace of pushing in that direction. Why not?

Dr David Joffe: I do not think it has been abandoned. A number of solutions are being pursued here. One of them is fossil gas with carbon capture, which relies on storage, in essence. So that is one of the options; it is likely that we will have at least one gas with CCS power plant in this decade.

There is a question here, though. Regardless of the fact that you are storing the gas and are therefore able to buy it, perhaps at less expensive times and so on, there is a value to getting off fossil gas in limiting exposure to it.

Lord Lucas: I meant taking carbon dioxide out of a cement plant and combining it with electricity to make methane.

Dr David Joffe: Oh, I see. That is technically possible. It is probably just the energy efficiency of that whole process.

Lord Lucas: You look at the systems efficiency, because you do not have to replace the infrastructure.

Dr David Joffe: Yes. It is worth looking at, but it has to be looked at in the context of whether it is worth doing it if we have to change the infrastructure a lot anyway in order to make the changes that we need for net zero. I do not have a clear answer for you.

Adam Bell: The only thing I would add is that, relatively speaking, that sort of electrolytic methane is quite an expensive fuel. Ultimately, when you are looking at how you would allocate electrolytic hydrogen and carbon in order to make that sort of fuel, you look at the highest-value application for it, which will probably be something like sustainable aviation fuel rather than gas, at least in the short run while these things remain expensive.

Baroness Young of Old Scone: Are you saying that the gas that the capacity market would hopefully produce will not be for long-term storage and energy security but, in fact, will be pretty regular in its use during a short-term lack of production in wind and solar? Are you also saying that the capacity market operators need to understand how profitable it will be and how much time it will be used for? None of this gas will be unabated gas; it will all be associated with some sort of technology that reduces its carbon impact. Is that what you are saying?

Adam Bell: There are two things there. On the first point, yes, the Government are currently planning to buy gas, and that will directly compete with LDES in the market. The way it is specified in the REMA consultation is that they will try to manage that through giving it a kind of running-hour cap. They have about 1,000 hours in the consultation as it stands, I think. That is about an eighth of the year. There is still a lot of the year in which they will potentially be forcing other forms of low-carbon assets out of the market. To me, that is a problem in the way the Government are structuring this.

On your second point, most of the assets that are brought forward with this should be carbon-capture ready, in theory. However, that requirement currently applies only to assets that are over 300 megawatts. In March, the Government provided an additional approval to a gas plant at Immingham, which has precisely 299 megawatts in capacity. I expect this to continue as the Government buy these sorts of assets via the capacity market.

Q129 **Baroness Young of Old Scone:** I have two questions. First, do you think that a developer of capacity would see that number of hours as economic? Secondly, how effective do you think the Government's proposals for the capacity market will be in producing the overall total of gas capacity that is envisaged?

Adam Bell: Fundamentally, it is about trading off costs. You can recover the costs via the wholesale market, the 1,000 hours of running time, or via the amount that you charge for your capacity in the capacity market. In the event that, say, the capacity market price is uncapped and is allowed to float, and the Government pay the marginal price for however much gas capacity they want to buy, you will not need to rely on that running-hour number in order to ensure that you can get your assets forward.

Again, it depends on how much the Government are willing to pay. Currently, the cap in the capacity market is about £75 per kilowatt. By itself, that would not be enough to bring forward gas for the running-hour limit of about 1,000 hours. You would probably need

Comment [AB]: I went back and checked and this is 750 hrs.

a slightly higher cap. If you want gas to run even less, you will need a higher cap again. So, again, the question is: what are the Government willing to pay here for these sorts of assets?

Dr David Joffe: Broadly speaking, you can divide the costs of a gas plant into the costs of building and owning it and the costs of running it. The costs of building and owning it will increasingly have to be covered purely by the capacity market, in essence, so that regardless of how much you run it your fixed costs—depreciation and the fixed operation and maintenance costs—are covered by a monthly or annual payment. To the extent that you run it, you get sufficient revenue from the wholesale market to cover those costs. Dividing in that way the set of costs faced by a power plant owner and the set of revenues makes logical sense. It is a reasonable way to bring forward a gas plant that will run only occasionally. I think investors would be happy in principle to invest in that.

The bigger problem is that no one may be willing to build unabated gas plants at the moment. The transition to running a regime in the 2030s is unclear. So can you build a gas plant and be sure of how many hours it will be able to run in 2033 or 2038? Also, will you have to make changes to that plant once you have built it? It is those sorts of things. The danger is that we get neither the clean solutions that we want nor the unabated fossil fuel solutions that the Government have now said we will need, because there is a lack of clarity. For me, the general lack of clarity is a bigger challenge at the moment. We have had the 2035 target for two and a half years now, and we still have not seen the plan for how that will be achieved. There was meant to be something from government in the spring on hydrogen and carbon capture readiness. I guess it is still the spring in government terms. We need to see that quite soon.

Q130 Baroness Young of Old Scone: Dr Joffe, you said with great confidence in answer to an earlier question that, of course, hydrogen would be part of the long-duration energy storage process and that that would be part of the solution to all this. But we do not seem to be hearing the Government say that. Has it just been lost in the weeds somewhere, or is there an absolute commitment? Are they against the hydrogen solution?

Dr David Joffe: I do not think they are against it. It is unclear to me exactly where it sits in their strategy. I guess that is the point of your question. I think it is pretty clear from the analysis done by a number of bodies, not just the Climate Change Committee—when I was there—in its report in March last year, but also analysis by the National Infrastructure Commission, the Royal Society and so on. There has been a lot of analysis of what a net zero-compliant

energy system will look like. You need something that essentially does the job that hydrogen would do, and there are not too many alternatives. So it does seem pretty clear.

The Government have that evidence and I am sure they are taking note of it. But I think there is also a reluctance to pick winners. That may be necessary in this case, particularly because of the long lead times. If we spend another three years deciding whether to have hydrogen storage, we will not have it by 2035. That makes the 2035 target much more difficult.

Baroness Young of Old Scone: So the Government are okay on picking winners in gas, but not on picking winners in hydrogen. Is that right?

Dr David Joffe: I could not possibly comment.

Q131 **The Chair:** How long does it take to build a new gas plant, and what is the lifetime of such a plant?

Adam Bell: The development window, depending on planning and so forth, is normally about two years for pre-development, another year for engineering design and a couple of years for construction. So you can assume about five years. Normally these plants have a lifespan of about 25 years. During that time you will replace the gas turbine at least once.

The Chair: So any developer who thinks that a Labour Government might get in with a plan to decarbonise the system by 2030 is not going to start building a new gas plant, are they?

Adam Bell: They will do it if they have a high enough capacity contract that they can let the plant basically just sit there.

Dr David Joffe: But that means that the lack of clarity around these things will potentially escalate costs. We are having to pay for things that people are pricing in because they do not know whether they will need it or not. Even if someone somewhere has a plan, which they have not communicated, that says that we will not need this thing, we will end up having to pay for it because of the lack of clarity in the market.

Q132 **Lord Borwick:** The Government said in their press release that they were requiring new gas plants to be built net-zero ready and able to convert to low-carbon alternatives in the future, such as carbon capture and hydrogen. Is this feasible? Are there any prototypes in this state yet?

Adam Bell: As I indicated, that requirement by itself is quite easily circumvented by engineering a slightly smaller plant. In terms of

technical capability, you can design a combined-cycle gas turbine to have a carbon offtake and enough space next to it to build an amine cycler. That is not necessarily problematic. With certain models of gas turbine, you can inject hydrogen up to a certain percentage of its overall fuel mix. Other turbines under development are entirely dual fuel, although they tend to be more expensive, for obvious reasons.

Lord Borwick: So the concept of UK fracked gas and carbon capture and storage would deliver the 2035 timetable. Is that correct?

Adam Bell: You could do it, but you would need to specify the requirements for either carbon capture readiness or hydrogen readiness to such a degree that you could not avoid them simply by building a lot of smaller devices. A lot of devices coming into the market are either 299-megawatts or much smaller. A lot of gas reciprocating engines are on a 50-megawatt scale. If you added together all the engines built around the country, that would effectively soak up capacity.

Dr David Joffe: Beyond the capacity limit, the 299-megawatt issue is clearly an important thing. If you were to have rules that required unabated gas plants to be built at some point to convert to hydrogen and carbon capture, you would need to know where those hydrogen and CO₂ networks were going to be, because you need to know whether it is okay to build a power plant in that part of the country. If you build a power plant in Southampton and it turns out that there will be no hydrogen or carbon capture infrastructure anywhere near it, it will not convert.

That has to be part of it. Part of what needs to be done as soon as possible is to set out the plan for where the infrastructure will be in order to inform a set of rules that not only solve the capacity threshold issue but require this stuff to be built in a net zero-ready way. It is not impossible to do it, but there will always be concerns about whether, if they are too stringent on the rules, we rule out unabated gas capacity being built at all and jeopardise security of supply. That will always be in the minds of the government officials, which makes it quite difficult politically to make that judgment about what the rules should be. Even if one can dispassionately sit back and say, "This will be fine", if you are a politician, your job is on the line and security of supply goes badly, that will be difficult.

So I understand that there is a reluctance to do it, but this transition will need those kinds of choices to be made. Otherwise, we will not get there by 2035.

Lord Borwick: But the task of distributing gas will be a whole lot cheaper than the task of distributing the same amount of hydrogen.

Dr David Joffe: Yes, partly because we already have the infrastructure, but it is not clear that you would necessarily pipe hydrogen around the country in the way that we pipe fossil gas around the country. Certainly, if we are talking about long-duration electricity storage, green hydrogen, where the electricity comes from, surplus renewables, the hydrogen going into a store and coming back out, and you have hydrogen turbines to regenerate the electricity when you need it, all those things can be located very close to each other and close to where the geology is suitable for hydrogen storage. So it is not actually clear that you would need to pipe hydrogen around the country for those reasons. Of course, if you then need to use it for industry or those sorts of things, there will be some need for pipelines.

Adam Bell: There is a certain kind of incoherency, though, in the way in which government is approaching this. It has a kind of hydrogen production target, and it is running an auction for new hydrogen allocation and for new hydrogen production capacity, which is great, but it does not actually say anything about where the hydrogen is going to go or what it is going to be used for, which means that it will go at the highest value use, which will almost certainly be decarbonising industry.

Therefore, much of the hydrogen production capacity we do build by 2030 might not have anything to do with power anyway. It might just be something else that we are doing to decarbonise a different chunk of the economy. So there is not necessarily a relationship between what we are doing on hydrogen and how we are going to solve the energy storage problem, which is probably why government is also trying to buy off all these gas plants at the same time.

Q133 **Baroness Neville-Jones:** I want to ask you about another puzzle in government policy. REMA proposes to discount the strategic reserve and the cap and floor mechanism as a means by which to ensure security of supply, but at the same time the Government still have consultations open for how they are going to support long-duration energy storage, which they have not solved, as well as hydrogen transportation and storage. That could include a cap and floor. So is there a contradiction here?

Adam Bell: I think there is a confusion rather than a contradiction. Government is trying to do multiple different things with multiple different sorts of instruments. It is trying to buy effectively a very

large volume of gas via the capacity market, and it chose that option because it is an existing instrument and does not involve coming up with anything new. I think that is a mistake, as opposed to just buying that gas via a strategic reserve, because, quite frankly, the amount we are going to be charged for it via the private sector will be so high that you might as well just buy the plant anyway. At least in that way, you are managing your exposure against forward risk and you can ensure that those assets are not competing with LDES.

The Government are opting for a cap and floor for LDES on the electricity side, because that is effectively what the industry has asked for. The capacity market itself works well for assets that have a certain output that can be delivered reasonably quickly. It is a lot more hard to deliver something like pumped hydro quite as quickly as a capacity market auction would operate. Pumped hydro has a wait time of about eight years, which means that you need to have very long-term certainty against your forward revenue to raise capital against it. The point of the cap and floor mechanism is mostly around pumped hydro, because it is a way of developing new contracts that can help companies to raise debts for those sorts of projects over a very long period while ensuring that they can still ultimately make a return.

So they have slightly different roles in the system, but the problem is that they are also at the same time all competing in the capacity market anyway. So pumped hydro will have an impact on the capacity market rates for technologies that do not get a lovely deal with the Government and, as a result, government has found itself in the process of picking winners once again, even though it did not necessarily intend in the mechanism to avoid that.

Baroness Neville-Jones: I remain extremely confused. Do you think then that the Government have left this consultation open, because they do not really regard long-duration storage as particularly important? What do you think their attitude to it is, or is it a question of whether the Government should own it?

Adam Bell: I think government views it as having an important role in the system. It has evidence that bears that out. What it does not have is a sense of urgency against delivery. We know from other markets that you can deliver long-duration energy storage quite quickly if you want to. In New South Wales, they are already nearly on to their fourth tender round for long-duration energy storage. They bought some advanced compressed air as well as some very large batteries and have started deploying those at scale as part of an effort to decarbonise very rapidly. The

mechanism the Government have chosen for this is kind of clunky, because it is designed for very large projects, rather than buying a lot of smaller projects quickly, and it will take quite a long time to deliver because government has explicitly said that it wants to enter into bilateral negotiations, which will be time consuming and ultimately probably quite expensive.

Baroness Neville-Jones: Do you think they will supply long-duration storage in a variety of means, rather than having a single bigger policy on, say, hydrogen?

Adam Bell: I think they will end up doing that by accident. The cap and floor mechanism will be used to buy some pumped hydro and perhaps a couple of other smaller assets. Other things will come forward via the carve-out in the capacity market. How they all stack up in the market and whether this is the right approach for discovering the most cost-effective grid mix is frankly very much up for grabs and will depend on the Government's ability to negotiate effectively with infrastructure providers, which they do not have a great track record of doing.

Baroness Neville-Jones: So where do you think we will end up?

Adam Bell: On current showing, the Government will end up buying a couple of pumped hydro projects in Scotland, and they will buy another project in the south—some form of liquid air or compressed air. Other projects will come forward, perhaps larger batteries and some more compressed air across the south of England. It will probably not be an optimal grid mix, to say the least, not least because all the pumped hydro projects have to be in Scotland because that is where the mountains are, and we will still be subject to grid constraints for some time from exporting from Scotland.

Baroness Neville-Jones: I see. Do you agree, Dr Joffe?

Dr David Joffe: Yes, broadly. This is extremely complicated stuff to achieve by market mechanisms, because you are constantly having to pull forward solutions that would not be brought forward by the market because they are relatively expensive. They are important and worth paying for, but it is quite difficult to get market mechanisms to push them through.

So what we are trying to do via a number of policy mechanisms is sort of push the economics to a point where companies will be willing to invest. But it is extremely challenging, not least because we are trying to do it through multiple mechanisms and, as you have highlighted, it is not clear that there is common thinking

underlying each of those. It is also because, even if there was common thinking, there are some assets that can be regarded as, say, long-duration energy storage but are regarded as on-demand power plants. Hydrogen power plants, for example, could be bracketed with a CCS power plant as some on-demand low-carbon power, or it could be bracketed with long-duration storage. Similarly, other forms of storage could be bracketed with flexible demand in terms of heat storage, EV batteries and so on.

It is actually quite difficult to try to do this via separate mechanisms, even if there is a single mind behind it all who understands how everything could fit together and knows that if you are doing this, you also need to do this and this. It is genuinely challenging. That does not mean that the Government should not try to do it, but when they assess all the consultation responses, they need to look at those together and decide what works for all those things together, rather than come to a separate conclusion on LDES versus hydrogen to power versus other REMA considerations.

I do not know whether there are people in the department who understand all that stuff well enough to make those judgments. It is genuinely complicated stuff, and the department does not have a great track record of retaining people who have that level of expertise.

Baroness Neville-Jones: I do not quite understand whether this is a question of plunging into choosing your technology, or whether, in order to try and understand what the Government are doing, you need to understand that they want the market to do it. They do not want to own anything themselves, they do not want a strategic reserve, and it is a question of who owns and who finances rather than the technology.

Adam Bell: It ends up being a mix of those approaches. The Government will tell you, and I am sure the Minister will tell you, that they want the market to solve these problems. At the same time, they also have instruments that specifically go out and buy particular sorts of projects, which is what the cap and floor mechanism is intended to do. The Government do not have a coherent philosophical approach towards the power market and have not had one for a very long time.

Baroness Neville-Jones: I see. I am a bit clearer about the confusion.

Q134 **Lord Strasburger:** Good morning. If the UK proceeds with new-build gas, are the targets to fully decarbonise the electricity system

by 2035, or by 2030 in the case of a Labour Government, still credible? How do we avoid being locked into gas all the way up to 2050?

Adam Bell: In all scenarios, and I think across both political parties, there has been a commitment to ensuring security of supply by having some form of gas available as back-up. This is not unreasonable. Until you have scaled hydrogen production enough to provide the same sort of system role, you will need large-scale gas to manage very cold periods with low wind and no sun.

I would regard a grid that used gas exclusively for those sorts of periods, which are known as Dunkelflaute in the trade, as effectively a decarbonised grid up until hydrogen is ready. However, what the Government are currently doing will not necessarily deliver that. It will deliver some gas plants that will be capable of competing on the open market for about 1,000 hours per year, and there is no way of avoiding them doing that. If we want to ensure that we can minimise the role of gas in the system in future, the Government should look again at the strategic reserve option, buy the gas plants that they need to ensure security of supply during those very cold, calm winter days—anticyclone days—and then, when they no longer need them, shut them down.

Dr David Joffe: There is an issue here, though. If companies build high-quality gas plants, it does not mean that they are irrevocably unabated. If they are built with the right rules and in the right place, and if the incentives are there, they can be converted to being low carbon. So I do not think we should be getting too hung up over whether we build a few new unabated gas plants this decade to ensure security of supply during the transition.

Of course, we are closing all the coal plants. We have some other challenges with nuclear plants closing, et cetera. I do not think we should be too precious about whether we have a new gas plant that runs unabated for two or three years before it converts to being low carbon, but it has to have that expectation that it will convert and the rules have to force that. That is the challenge. We need to hear a lot more from the Government about exactly how they are going to do that, because at the moment there is a lack of clarity there.

The Chair: And you need the CO₂ infrastructure to collect the CO₂ that it is capturing.

Dr David Joffe: Yes.

Q135 **Lord Strasburger:** Do you think that these were the right targets

to start with? Is there a risk that, if they are not met, this will make the rest of net zero much more difficult to achieve?

Dr David Joffe: I think the 2035 target was the right target in the first place. My team at the CCC recommended that target in 2020 and the Government accepted it in 2021, but it is worth pointing out that we are now two and a half years on from the Government accepting that target, and the progress so far has not been as rapid as one might have hoped, if I can put it diplomatically.

Lord Strasburger: You are being diplomatic.

Dr David Joffe: It is too slow. Therefore, the 2035 target is looking increasingly stretching, not because it was the wrong target but because the policy response to setting that target has not been quick enough.

As a former target setter at the CCC, I think that the value of targets is in the policies and actions that they drive. It is not in the targets per se. If the targets help us to get closer to those outcomes, they are worth having, but not if they then drive perverse actions from policy—that is, emergency reactions to a lack of progress. It has to be a smooth transition. If we end up getting to a fully decarbonised system a year or two later than the target, the amount of extra emissions that would come from that is very small. So it is important to keep in mind that are the solutions that we need and we should be pushing ahead with them with urgency. But on round-number year targets there is no reason why it has to be 2035 rather than 2036, for example. The targets are there to concentrate minds, really. That is the important thing.

Adam Bell: For me, the advantage of the targets is that they function as an organising principle for government. They require Governments to structure their activities around that target, and shorter-run targets rather than longer-run targets force that issue. If Labour wins the next election, delivering the 2030 target will require cross-government organisation on a scale not seen for a very long time. It will require action across the planning system, across transmission and across generation, as well as the design of some novel mechanisms to deliver things at pace. If they miss the target—that is, they hit it by 2032—as David said, it does not really matter against the overall challenge of decarbonisation. But it does compel Governments to work together in a much more joined-up way, in theory.

Lord Strasburger: It sounds almost like a wartime project to galvanise the whole Government and the whole of industry in such a short time.

Adam Bell: That is the right way of thinking about it.

Q136 **Viscount Stansgate:** Do other Governments and their policies towards long-term, long-duration energy storage do better than us? Can you give us examples of who they are, why they are better and what they are doing that indicates that they are making better progress in this area than we are?

Adam Bell: There are a couple of examples. I mentioned New South Wales in Australia earlier. They are looking to decarbonise at pace and are buying a lot of long-duration energy storage in the form of open tenders for specific storage volumes. They have run about four of these so far and have procured a lot of dedicated long-duration energy storage projects, plus some mixed solar-plus battery projects. This has meant that Australia is now very much the exciting market for an awful lot of the LDES players I speak to. They are all looking at how they can move some of their operations down there because that is where the money is going. Some interesting work is also being done in California.

Just to provide a bit more context, the Australian market is a little closer to ours in its structure. The Australian model is that they offer a minimum revenue guarantee for all their LDES projects. That is effectively what the tender is for; they do a cap and floor mechanism that is just a floor. The California market is different, because everything is dispatched by a system operator rather than by generators switching themselves on and off. It means that the system operator who has sought to buy some long-duration energy storage can switch it on and off as efficiently as it can to fill in the gaps between wind and solar, as well as where it needs to use batteries. It is a very interesting model for LDES; it is very much the best-use case for it.

Viscount Stansgate: Thank you. Is anyone using hydrogen?

Adam Bell: Not at scale for power generation.

Viscount Stansgate: What about for storage or reserve, such as strategic reserve?

Adam Bell: Not at present, no.

Dr David Joffe: No. Reflecting on the energy systems that there are internationally now, those sorts of roles in different countries have been performed by fossil gas storage, for example, and by hydro to some extent. Some of the systems do not need long-duration storage because they have hydro, which is much more flexible in the way it generates.

It is important to emphasise that different energy systems are really quite different internationally in how much of this kind of storage they need. That is because of different geography, and therefore what hydro and geological storage of things is possible, and because their demand shapes are quite different. The requirements for storage are therefore different. We absolutely should be looking internationally for lessons, but it is often hard to find a country that is analogous to the UK for precisely the sorts of things that we are looking at.

I have one thing to say on fossil gas storage. It speaks to the UK's attitude to the strategic value of long-duration storage. We had fossil gas storage in the UK, but we let it go by the wayside to some extent. We had to bring back Rough in emergency circumstances a couple of years ago. This speaks to an attitude that we do not need to make sure that we have that storage there and the energy provision for—I was going to say, "a rainy day". It is not the rainy days that we are worried about, but I mean that sort of thing. It suggests that, in countries where they have the gas storage, maybe they have done some thinking that we have not.

Viscount Stansgate: Would it be fair to say, on the basis of what you know about what other countries are doing, that no one is looking at using hydrogen for long-duration energy storage?

Dr David Joffe: Lots of countries are looking at it, but no one has done it yet. That is the difference. Let us come back to lead times. The lead time for geological hydrogen storage might be eight years, for example. Very few projects are under way for those salt caverns, let alone having actually reached the point where they have been delivered and are operational. There is a lot of interest, though; a lot of countries are thinking about this. The challenge of decarbonising electricity systems will be one that all countries have. How much long-duration energy storage and what kind will vary, but a lot of countries are interested in hydrogen storage.

Q137 **Lord Berkeley:** David, you have just mentioned salt cavern storage. I was not a member of this committee when there were the interviews for the report, but in paragraph 66 there is the recommendation to combine on-site electrolysis hydrogen storage in salt caverns and electricity generation from hydrogen. I suspect that you have been promoting the salt cavern recommendation as well, but for the last nearly 100 years the salt caverns in Cheshire, which are presumably the ones that are being referred to, are underneath the West Coast Main Line. Network Rail has had to monitor the settlement of the ground continuously for 100 years because it keeps on going up and down with the amount of salt

taken out.

Is it safe to be putting hydrogen, gas or anything else in an environment that might go up and down and probably leak a bit? There are some academics in Cheshire who have done a lot of work on this, and I am quite surprised that onshore salt mines are being even thought about. As regards the gas we have been talking about, I can understand that in relation to offshore but, as regards onshore and the movement of ground, I am quite surprised. Is that really feasible?

Dr David Joffe: Safety is extremely important, and we should not be doing things that are unsafe. Not all potential hydrogen salt cavern locations have those challenges with railway lines and those sorts of things. There are four areas in the UK where the geology is suitable for salt cavern development, and I am sure that some of those have fewer challenges than those that you have described.

There is a more general point and it is something that we have experienced with fossil gas in the past. The Netherlands in particular has had issues with seismicity from gas production and those sorts of things. If you are doing geological development, sometimes there are impacts on the local area. Sometimes that is fine, because there is no one is living there and that is okay, but if there are people living there, we need to take that into account. It is also important to remember that in order to get to net zero we will need to build stuff. Therefore, the threshold for people objecting to it has to be a genuinely important safety case rather than just saying, "We don't really want this infrastructure here".

Q138 **Lord Berkeley:** It would be good if you could write to us with a list of sites that you think are suitable, because I have not heard of them from the academics I have been talking to.

Anyway, leaving that aside, what are the implications if we rely on gas? That is coming, given the answers that you have both given. It is most likely that the Government will choose gas as one of the prime sources. Are you concerned that relying on gas storage will put the Government at risk for energy security because of the high wholesale gas prices when renewable generation is low or during squeezes such as those in 2022? The price has gone up and down quite a lot and frightened a lot of people.

Adam Bell: The answer is very much yes. There is a far too plausible scenario in which our access to LNG cargoes via Suez and the Cape are disrupted by some sort of conflict in the Middle East and, at the same time, flows from the east are disrupted by some sort of general war there. For me, this points to a need to understand what volume of storage you need to procure, if you are

using gas as your strategic reserve, to ensure that you can completely insulate yourself against supply shocks to minimise not just price risks but physical security risks.

The Government have not necessarily considered this, mostly because they are very much wedded to the notion that the LNG market is deep and liquid. That is currently true, but we can see from the past few years that that will not necessarily always be true. Governments should take this into account when thinking about secure supply.

Lord Berkeley: Thank you, but do they have sufficient storage plans to allow for that, regardless of how long it is going to take for the ups and downs?

Adam Bell: No. The only meaningfully large store is at Rough, which is not at full capacity yet. There are other sites where we are looking at storage, but there is nothing to bring them on stream in anything like the time that might be required.

Dr David Joffe: It is worth reflecting—we have seen this over the last two years when gas supplies were very disrupted across Europe—that the UK was relying on the gas storage in continental Europe. The situation was helped by the UK being able to import LNG cargoes, but fundamentally it was continental Europe that was that was storing the gas. Without that, the UK would really have struggled.

Lord Berkeley: It goes back to your answer to the previous question from my colleague.

Dr David Joffe: Indeed. More generally, the exposure of the UK economy to gas imports is too big at the moment. We produced I think 54% of the gas that we consumed last year. North Sea production will continue to decline, because that is what gas basins do. There is very little in the way of new finds for gas. For decarbonisation, not just of electricity but of the way we heat buildings and industry, we need to get off gas and to decarbonise merely to keep the level of gas import dependence at its current level. The CCC's pathway on the way to net zero has the rate at which gas consumption is coming down as roughly parallel to the rate at which the North Sea production is coming down. Just to stand still on gas imports, we need to reduce our consumption rapidly along those lines.

The Chair: Presumably there is a really positive benefit to the economy from reducing these very expensive imports.

Dr David Joffe: Absolutely, and the OBR has done some work on the impact of volatile fossil fuel prices on the economy. It is clearly desirable to minimise the impact of that volatility. We saw not only the impact on energy bills over the last two years and what that did to household finances and the economy and so on, but that those energy bill impacts were limited by government policy in a way that hugely impacted government finances. We do not want to be in that situation on a repeated basis. The only way we can avoid that is to reduce our dependence on fossil gas and imports. Even apart from decarbonisation, that is worth doing from an energy security perspective, complemented by things like LDES that give us a bit more resilience in the system that otherwise we lack.

The Chair: Presumably it is not just the question of the volatility of the prices. We are replacing imports with something that we are producing locally.

Dr David Joffe: In terms of the economic impact, yes. The modelling that was done for the CCC in 2020 said that there was a significant benefit in replacing spending on imported products with domestic investment. That depends on some assumptions about how much spare capacity there is in the economy and those sorts of things. It is not universally accepted that there is a clear macroeconomic benefit to this. It depends on what you assume about the state of the economy. I am not sure that all parts of the Treasury completely buy that story, unfortunately.

Q139 **Lord Drayson:** We have a session with the Minister next week. What questions would you want him to be asked on this area of policy? Please be frank.

Adam Bell: Given that he is new in role, I am not going to be completely mean, but I will be to a degree. There are some important questions that it would be helpful for him to explain. How much is he willing to pay for pumped hydro if the Government choose to go down that route, because it is a large cost over a very long period and other technologies are available? Will the Government step in if all these unabated gas plants that they are looking to procure via the capacity market start pushing long-duration energy storage out of the market? Can they commit, if they are going to deliver a cap and flow mechanism, to this being an open and transparent scheme on the lines of the New South Wales tender process?

Dr David Joffe: It is good that we do not have the same questions. That is very good planning. Mine are on the level of ambition and the planning for what the system will look like in 2030.

The Government have their 2035 target, but they have also published numbers suggesting that the system should be 95% decarbonised by 2030, which, frankly, is not far short of 100. So my questions would be these. Does that remain the objective? Does he think that it will be achieved? What is the plan for it, and why have they not published it?

An associated question concerns whether that high share of decarbonised generation in 2030 is concentrating minds in the department. Is that target having a galvanising effect along the lines that Adam described earlier, or is it just, "We'll do this as fast as we're doing it and we'll get there when we get there"? Is it actually concentrating minds?

My final question—it is probably a bit unfair on a Minister who is new in post—would be: does he think that the department's focus has the right balance between getting stuff built versus worrying about what the operation of the system might look like in the next decade?

Q140 Lord Drayson: Thank you. I will probe you a little further, if I may, to understand the background—that is, the picture the committee is getting about the lack of coherence in the Government's thinking. In your evidence today, you have said that the Government do not have a good grasp of the market dynamics and are incoherent in the way they are thinking about this, with no sense of urgency and delivery. You have also said, very interestingly, that they do not have a track record of retaining the people with the necessary expertise. Thinking about the need for a future Government to address this problem, why does the department not retain the necessary expertise? Is it an ideological problem? What has gone wrong in the department?

Adam Bell: A number of former civil servants have left the department. There are a number of reasons for that, some of which are Civil Service-wide and some of which are specific to the sector.

The first is that, generally speaking, decisions take a very long time, and it is frustrating for the ambitious in effect to wait for things to happen. There are reasons why it takes a long time for things to happen, including changes of Minister, uncertainty around government policy and waiting for more evidence, but there is very much a sense of a lack of urgency at the centre, which makes more ambitious people less inclined to stay.

There is also the challenge that it is very hard to specialise in the Civil Service. The Civil Service is structured around creating excellent generalists rather than necessarily saying, "We want to

retain expertise because we will require it". This is fundamental to the Civil Service. I know it is aware of this, but serious action has never really been taken on it. Another point is that the Civil Service simply pays less well than the private sector for expertise and for experienced individuals, so it is often outcompeted.

Lord Drayson: That is very helpful.

Dr David Joffe: Adam has much more insight than me, because he used to work in the department, whereas I have always been an outsider.

Lord Drayson: As an outsider, what is your perspective on what has gone wrong?

Dr David Joffe: I definitely share Adam's perspective: that there is a perception that it is all too slow and that it would be quite frustrating to work in the department. There is a reason why I have never ended up there, I guess. That is part of it, as is the abundance of generalists and the perception that the department does not value detailed expertise and long-term knowledge in the way that I think they should.

Q141 **Lord Lucas:** Do you think we should ask him what he expects the price of electricity to be in 10 years' time? What do you think he should answer?

Dr David Joffe: I have no idea what the answer would be. I think it would be very unfair to ask that.

Adam Bell: It would be funny, though. I think you should ask him what he expects the size of the bill to be in 10 years' time, because the department does work on that and will have a sense of what it is going to be. The price of electricity is not by itself the thing that matters to consumers or business; it is the additional cost on top of that that it would be important for them to understand and to seek to manage down.

Q142 **Lord Berkeley:** Do you think it would be worth asking the Minister, "Have you thought of introducing a policy to consume less, to need less and to reduce demand for power?"

Adam Bell: A number of policies have tried to do this. It is fair to say that they have been unsuccessful to a very real degree. There are some examples of good practice in government, including the local authority delivery scheme, which was about encouraging local authorities to deliver various upgrades to homes. There are lots of things that you could do through the deployment of things like heat pumps, which require less primary energy than, say, gas boilers.

There are other things that you could do related to building stock and how better to co-ordinate existing policies in order to ensure that you are maximising the benefit of particular sorts of investments, and so on and so forth.

Lord Berkeley: And the insulation of homes. There are so many things.

Dr David Joffe: It is worth saying that most of those things will reduce fossil fuel consumption, not electricity consumption. Actually, the policy imperative is to move away from fossil fuels towards electricity and, therefore, to push up demand for electricity. It is important to recognise that distinction.

The Chair: We have come to the end of the session. I thank our witnesses very much. If you are able to send us any indication of the distribution of salt caverns in the UK, in response to Lord Berkeley's question, that would be extremely helpful.