



Industry and Regulators Committee

Corrected oral evidence: Ofgem and net zero

Tuesday 7 September 2021

11.45 am

Watch the meeting

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

Evidence Session No. 6

Virtual Proceeding

Questions 64 - 69

Witness

I: James Richardson, Chief Economist, National Infrastructure Commission.

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Examination of witness

James Richardson.

Q64 **The Chair:** I welcome you to the second panel of today's inquiry, the fifth oral evidence session. We are joined by James Richardson, who is the chief economist at the National Infrastructure Commission and also sits on Ofgem's challenge group, so he is very familiar with the workings of Ofgem and the pricings of Ofgem. In particular what we want to talk about today is the economic plan that has been put forward by the Climate Change Committee. We have just heard from the chief executive and his chief economist and we have had a very interesting discussion about his budget and some of the big policy questions and implications that lie behind it.

Obviously, you have looked in some considerable detail at the budget. It would be useful to have your view of its status, as it were, as a piece of economic planning, and its robustness. It would be interesting to know whether you have had access to the detailed underlying assumptions and some of the cost implications and costings of things such as decarbonisation of electricity so that we can get an independent sense of the robustness and where there are areas that need more work. We appreciate that innovation will change the game along the course of this journey to 2050, but is there anything in particular—after you have answered all the other points—that strikes you as being worthy of additional interrogation and work?

James Richardson: Thank you, Lord Hollick. It is a great pleasure to be here this morning. We have done our own estimates of the cost of decarbonising the UK's infrastructure—electricity, heat and transport—and we have also looked at the cost of greenhouse gas removal, bioenergy with carbon capture and storage or direct air capture, which are likely solutions in the very hard to decarbonise sectors such as aviation and farming.

We have not covered absolutely everything that is in the CCC's estimates. We have not looked at the cost of industry, but we have covered most of what is in its sums with our own estimates. It is fair to say that our numbers are pretty similar. There may be some shared assumptions there that help drive that, but that does give us some confidence that these basic figures are in the right ballpark.

Inevitably, forecasting anything over a 30-year horizon, particularly when we are depending on a series of technologies that are at different stages of development and many of which are not commercially deployed very widely, there is a good deal of uncertainty around these estimates. We try to emphasise in our reports that policymakers should not hang their hat, as it were, on small differences between large numbers.

In terms of the big picture, certainly we get the same overall picture as the Climate Change Committee and I think that is fairly reliable. I would characterise it as saying that the cost of electricity on a unit-cost basis, per kilowatt hour, is probably going to stay broadly similar to what it is

today. It will be made up quite differently. A lot more of that cost will be the cost of capital and a lot less will be the cost of fuel. A substantial part of the price of electricity is the fuel that is used to generate it and of course a zero-carbon system would use a great deal less fuel. But overall, on a kilowatt-hour basis, we would expect the cost to be pretty similar to today.

The bill will be larger because people will be consuming more electricity. Instead of filling your car with petrol you will be filling it with electricity, so you will of course be buying more electricity. You see these very large figures for investment in the electricity sector, but it is always worth remembering that the electricity sector is doubling in size in most of those estimates, so the cost of the system is roughly doubling as well. Basically it looks to us as if electricity is fairly stable in terms of its price.

Transport is the big saving. We know that the petrol engine is a very inefficient technology. It converts only about a third of the energy content of petrol into motion. Diesel is a bit more, but it is still less than 50% efficient, whereas an electric motor is about 90% efficient. As we start to see the costs of electric vehicles fall on the back of falling battery prices, there are potentially very large savings for households and businesses from the cost of travel because the energy cost of movement falls quite significantly. Electric vehicles also have lower maintenance costs, and so on.

Conversely, and very challenging in all this transition, the cost of heating homes and buildings is likely to rise quite substantially. That seems to balance out with the savings from transport in our modelling and in the CCC's modelling, but it will fall differently to different households. The household that has no car but high heating bills will lose out, whereas one that travels a great deal but perhaps has a very well-insulated or small property may well gain, so there are significantly different effects between different households and no doubt between different businesses as well.

There are some sectors where there are clearly going to be costs—aviation, agriculture, industry. It is difficult at the moment to see how you can decarbonise those at today's costs. We do not see those costs as particularly excessive. We looked at the backstop technology. If you cannot decarbonise something such as aviation, if you cannot make a hydrogen-powered plane or an electric plane for shorter distances, the backstop technology is to extract the CO₂ back out of the atmosphere either through bioenergy with carbon capture or direct air capture. We think these technologies can and should be developed. It is not a cheap option and we think it will potentially cost somewhere between £100 and £400 per tonne of CO₂, which is more expensive than almost all the decarbonisation options being looked at.

However, if you spread that across a household and ask what it would cost a household to offset its residual CO₂ emissions, the ones that are very hard, that probably comes out at a cost of £200 a year for a household in 2050, somewhat less than 1% of household expenditure.

That would be brought in pretty gradually. Yes, there are definitely some areas where there will be costs. There are going to be some winners and losers and that distributional question will be important, but the overall picture that we see in the CCC's numbers is very similar to the one that we see in our numbers and it is credible from an understanding of the technologies.

You asked about the risks and uncertainties. That is clearly a critical question here. As I said at the beginning, no one should take any detailed number particularly seriously, as with any long-term economic forecast, to be honest. This should all be taken in the context of what might happen to household incomes over this time, which again is very uncertain. We have seen a decade of pretty stagnant incomes, but we might hope that that would change over the next 20 or 30 years.

However, there are some particular uncertainties that are worth focusing on. The first impact, the obvious one, is technological change. All these plans do rely on technologies at different points of development. Our modelling and the CCC's is pretty similar. It tends to assume technologies that are at least reasonably well developed to commercial pilot phase. We are not relying on nuclear fusion or some of these technologies that people are actively developing, but which you would not want to rely on being available in the next 20 or 30 years. We are relying on technologies that are fairly well developed.

The challenge there is more around what they cost. If you look at something like the production of hydrogen, we know that low-carbon hydrogen can be produced. You can do it today and that is not a challenge, but how much it costs to build an electrolyser in 2030 or 2040 is inevitably very uncertain. There are lots of estimates of falling costs and we might hope to see those based on similar technologies in the past, but of course you cannot be certain until you do it. That is true of a range of these different technologies. We try to make relatively conservative assumptions about how much costs will fall. To the extent that we have been caught out so far, those have tended to be positive surprises. Prices have fallen faster than we had projected, but those could go the other way.

The other thing that is important to think about here is the cost of capital. What you end up with here is an energy system that is much more capital-intensive and much less fuel-intensive than the one we have today, particularly if you also go down a heat-pump route for heat, somewhat less so if you go down a hydrogen route. Therefore, the cost of capital starts to matter much more. We are fortunate in a sense in making this transition at a time of historically low interest rates and that is a factor that brings down these costs, but there is no absolute guarantee that that period of low interest rates will continue. If you saw a big jump in interest rates back to what we might think of as more normal levels and you multiply that through by investment programmes of £40 billion or £50 billion a year, it would start to add up substantially. You might hope that that would be accompanied by faster economic growth or

some other reason for those higher interest rates, but it is a key uncertainty here.

The final key uncertainty is how many mistakes we make along the way. Perhaps inevitably, all of this modelling tends to assume that you make the right decisions and you implement them in a sensible, rational way over a reasonable timetable and you are not trying to rush to catch up, you do not run out of fitters to install heat pumps in people's homes and so on. If you get that wrong—and we are seeing supply chain problems across the economy today for very different reasons—but prices can go up, investments can be made that then turn out to be the wrong ones and those things clearly could impact on the cost of this transition.

The Chair: Thank you very much indeed. One quick follow-up. You lay emphasis in your report on the need to create markets to supply goods and to promote innovation. This is very much a message that we received from Dieter Helm at our previous meeting. You may want to deal with this in the next question from Baroness Bowles. It would be helpful, when you answer her question, to give us your idea of the specific policies and the specific product areas where you think the Government need to create a market. With that interaction, could I pass you over to Baroness Bowles? This sits below her question.

Q65 Baroness Bowles of Berkhamsted: Thank you. In addition to what Lord Hollick has just said, we heard in the earlier session from Chris Stark that he felt that things were coming together, but that there was still a lot more that needed to be done to meet even the current targets that are set, and everybody is awaiting with great interest the heat and buildings proposal. Overall, what further clarity is needed on the Government's plans to reach net zero?

Also building on what we heard in the previous session, where in particular might the Government have to take a more proactive lead, not just in setting targets and policy but in getting things done, such as a transfer? In your view, what are the elements of the government policy that are the most important for reaching the net zero objective? Alongside importance is also the timescale. If something is very important, there is an assumption that therefore it must be brought on quickly.

James Richardson: Yes, we would move a long way forward if the Government published the set of strategies that they have promised us. I hope that we will see these shortly. We have just had the hydrogen strategy fairly recently. The biggest piece where there is a lack of clarity is heat and buildings. We have been promised the heat and buildings strategy for some time. It is a very substantial part of overall emissions. It is extremely difficult for a whole series of reasons. Undoubtedly transitioning the UK's stock of housing and commercial buildings to a new form of heating will take a long time, therefore starting soon is important. It is the biggest and probably the hardest element of the whole transition and the one where we need to see the heat and buildings strategy.

The other two big pieces that we are waiting on will fill in very important gaps. We are waiting on the Treasury's review of essentially who pays for this. Again, it is a very difficult issue. I know your committee has been exploring this. Greater clarity about what the Government—the taxpayer—will fund and what the consumer will fund will enable more of these business models to be established. It will become clearer what the right approach to competition is, to go back to Lord Hollick's introductory question. That will make a great deal of difference.

Then it is the overall strategy which brings these things together. It is perfectly sensible of the Government to have issued a series of strategies for particular parts of this issue, because if you try to put it all into one document you run the risk that it is a thousand pages and very hard to digest. But we do need to see how the Government see all these pieces fitting together. That would include the big pieces of: electricity, where we have had the energy White Paper; transport, where we have had the decarbonisation plan; heat and buildings, where we are expecting the plan; and industry, where again we have had a plan. In some of these more niche but more difficult areas, such as engineered greenhouse gas removal and direct air capture, we are waiting for a response on a report we published over the summer. Things such as aviation, shipping and agriculture are relatively small parts of the problem, but if you want to get to net zero you have to address all of the problem.

Overall, the Government have been quite good at setting market mechanisms where we have seen strategies. We have seen that in the hydrogen strategy, with carbon capture and storage, and in the electricity sector, and we have seen a commitment now to introduce legislation to allow Ofgem to introduce competition in onshore transmission, so there is a general push in that direction of enabling competition and using it at different levels. The nature of those markets does inevitably depend on the kinds of investments that we are looking at. If you are building very large long-term capital assets, whether that is a transmission line or an offshore wind farm, government intervention tends to be around ensuring pricing and quantity stability and then you use competition to drive down the price of a guaranteed income stream, essentially. That has been very successful.

But in some areas you have more varied technologies. If you are looking at dealing with local constraints on the distribution network, you might use something such as batteries or you might use demand side response, where devices in the home switch on and off in response to price signals, or you might just build a cable. More of a conventional market mechanism with less government intervention can probably operate there because you have smaller-scale interventions where the certainty around the capital is perhaps less of an issue, but also the competing technologies are so much more different that it may be hard if there is a classic auction model such as the CfD model.

The Chair: Anything further on that?

Baroness Bowles of Berkhamsted: I am reasonably happy with that. I

would love to go into the whole cost of capital thing a little bit more, but that is not really my question.

Q66 Lord Curry of Kirkharle: Thank you very much indeed for your responses to date, James. We heard from our earlier speakers from the Climate Change Committee—and you have confirmed this—that a significant capital-intensive programme will be required in order to achieve the Government’s net zero ambitions. Crucially, a lot of this needs to take place by 2030, so the next decade is critical in establishing the platform to meet the net zero target by 2050.

The assumption in the Climate Change Committee report is that the private sector will invest significantly and that there may be energy efficiency savings afterwards. Nevertheless, the upfront capital cost will be huge, particularly in decarbonisation of homes and so on. What are your views as to how this split of responsibility will fall out and to what extent will the Government need to provide either incentives to the private sector or grants to private homes to decarbonise? We know how attractive the tax rises are and that will be debated today, no doubt. Where is the funding coming from in order to achieve this capital investment?

James Richardson: It is an absolutely crucial question in all of this. Perhaps I can separate it out by sector because the answers do look different for different parts of this. In the electricity system, there is a reasonable expectation that this can be financed in the private sector, that existing mechanisms have been very effective in bringing forward large amounts of investment. That is the CfD model for generation and it is the regulated asset-based model for distribution and transmission investment. Both these mechanisms have led to very large increases in investment already. They provide investors with a kind of certainty around the factors that they cannot control—government policy and so on. Inevitably investors are unwilling to take on those kinds of risks. These mechanisms provide certainty against those kinds of risks and have brought down the cost of capital on things such as offshore wind farms and brought in very large amounts of investment.

Those existing mechanisms are likely to continue to apply. You could iterate them over time, and the Government have been looking at minor modifications to the CfD process, but basically we have a set of tools that are proven and can deliver that investment. In electricity, there is a pretty clear source of demand here and it is fairly clear how this will be paid back in the end.

Then you have to look at transport. Of course, people buy their own cars and that will continue, so that part of it is pretty straightforward. Clearly it will require some continuing subsidy, as we have at the moment for battery electric vehicles, until the costs fall and they are comparable, but it is relatively small in the overall scale of costs here. Most forecasts suggest that battery electric vehicles will have price parity with a conventional electric vehicle by the back end of this decade and then the fuel costs, the maintenance costs and so on are pure savings. Again,

there is little reason to expect large-scale government support for cars, vans and so on. The railway may be more difficult. It is small in the overall scale, but it is much harder to push those costs on to the private sector, but most of the capital costs in transport are for vehicles.

For electric vehicle charging, there will be a need for some government support. The Government have committed fairly substantial sums of money for that and we have also seen a willingness by Ofgem to shift where the costs of upgrades to the network are for electric vehicle charging in the publication that came out over the weekend. The costs of charging are likely to be split, with taxpayers picking up some of that, I imagine particularly in rural areas and so on where it is harder to make these things commercial, just as we have seen with broadband or indeed in the past with water and electricity, where the Government inevitably subsidise these networks reaching the less-populated areas. But the costs of network upgrades fall to consumers, who will benefit from the advantages electric vehicle charging brings to the system as a whole.

Then you have heating. For consumers, it is by far the hardest element here. Within the technologies you see very different patterns. If you go down a hydrogen-based route, most of the additional costs there are the cost of hydrogen relative to the cost of natural gas. It is likely to be 30% to 40% more expensive per unit of energy for hydrogen than natural gas, whereas the cost of a hydrogen boiler is probably going to be the same as an existing boiler. There are some infrastructure costs to upgrade the networks and so on, but a lot of that is taking place anyway for safety reasons, so the fixed capital costs of that route are relatively low, but the fuel bill will be significantly higher.

Alternatively, you can go down the heat-pump route. Of course, one can combine these at each household level, where the energy costs are very similar. Because a heat pump is so efficient, the cost of electricity would be similar to the cost that households are paying for gas today to heat their homes, but the cost of the heat pump itself is much more substantial. There it is very difficult to see households being able to bear that all in one go. It is very difficult to see how £10,000 a shot is something you just say that households can pick up.

You then have two options in that world. First is that the Government subsidise at least part of that. We have been promised grants of some sort and are awaiting the details of that in the heat and buildings strategy. The other is that intermediaries may step in, and energy companies also, to finance this and spread the cost for consumers. That is a possible business model where companies start selling people the heat in their building, if you like, rather than the energy input, so the company owns the heat pump and spreads the cost. If that took place, there might be less need for the Government to get involved.

Finally, in the industry sectors that we have looked at a bit less than the others, inevitably the question there is around competition with other countries. If everybody in the world is imposing costs on the steel industry or the cement industry, then you can put the costs on to the

industry and it will pass it on to its consumers through somewhat higher steel prices or somewhat higher cement prices. But if other countries are not doing it, then it becomes incredibly difficult to impose those costs in tradeable sectors, because that just leads to offshoring. Therefore either the Government are going to have to pick it up, as they seem to be proposing for the carbon capture and storage solutions here, or you need some kind of carbon border adjustment mechanism that allows that to be equalised at the border, in which case again you could put the cost on the industries, but make sure that that was equalised regardless of where the production took place.

Lord Curry of Kirkharle: That is a very helpful analysis, James. Could I ask one follow-up question? Previous individuals giving evidence to us have suggested that we have a massive infrastructure problem in that it is designed around large carbon generation and energy generation and that will change dramatically. You rather dismissed the investment in infrastructure as not being of crucial importance. Is it important?

James Richardson: I did not mean to dismiss it as not being important. It is absolutely vital, as the CCC said earlier. Decarbonising the electricity system gets you a long way not just in electricity but in many of these other sectors. My point here is that we have the mechanisms to deliver this. We have mechanisms that are tried and tested and that have delivered significant increases in investment already. Therefore, I think we can be confident that we have the mechanisms that investors know and investors have confidence in and that it is clear how that gets repaid and how that gets funded, how the cost of capital is set in ways that balance the various interests here. Therefore, I do not think we need to worry about how that is done. There are clearly delivery challenges. The scale of change here is enormous, but I do not think the challenge is bringing the investment in.

Q67 **Lord Eatwell:** I am interested in the issue of resilience in an infrastructure system, particularly in this case the energy system. That comes down to security of supply issues and so on, which have been debated significantly in terms of the consequences of the move to renewables. In some of the answers we have had from previous witnesses, there has been a degree of doubt in that we have at the moment essentially a market strategy for pursuing this fundamental change, with a lot of the investment being expected from the private sector.

Resilience requires redundancy, and competitive markets hate redundancy and indeed are highly biased against redundancy in any delivery system. How confident are you that we have a strategy that will deliver an energy system with the requisite level of redundancy to be truly resilient to the sorts of shocks that we have sadly become rather used to over the last 20 years?

James Richardson: Again, it is a key challenge. Any electricity system needs to manage security of supply and this has been a challenge since the very earliest days of electricity because it is a difficult commodity to

store. Those challenges look different with a highly renewable system because you have new sources of variability, but they are all part of a fundamental need to continuously balance supply and demand.

There are probably two issues. First, do we have technical solutions that enable us to do that in the system where the weather becomes a key factor? The other question is: are our market mechanisms fit for purpose to bring that forward? The first half of the answer is pretty firmly yes. Some of this, it is fair to say, is dependent on technologies that are not fully developed yet, but there are a range of flexible technologies—battery storage, interconnection, demand side response, some quite old technologies such as pumped hydro—that provide backup. Then there are some newer technologies—for example, hydrogen-powered gas turbines—which would be very well matched to a highly renewable system, which we think can potentially provide a big part of a flexible solution, but that are less technically developed. There are quite a range of solutions here that enable you to back up the system.

As you say, you have to have that. You have to have that backup. Of course it has always been true in electricity. Victorian power stations used to have batteries to back up their supply and it is part of the role of the regulator to ensure that the system is backed up and also of the Government to ensure that the money is in the right place.

Lord Eatwell: How do we then tune the market mechanism to ensure that private companies are willing to build capacity that they expect not to use?

James Richardson: Broadly, there are two basic answers to that question. The first is that we allow the price to rise at the point when we need the backup. Prices are very volatile in electricity markets.

Lord Eatwell: So you price out the poor when there is a lack of electricity?

James Richardson: That is not how it works at the moment. You price the wholesale price up and then those prices are smoothed over time, so retail consumers are not exposed to that volatility but the wholesale market is. Those very high prices in the wholesale market then bring through power stations that fire up for a few hours or a few days a year.

It is important that that volatility is managed through the market so that consumers are not overly exposed. It is a challenge in the system that we want to build that some price signals here are valuable because we do want to be able to shift the timing at which people would charge their electric vehicle. They may come home at night and plug it in when they get home, but we do not want them to charge it at the evening peak. It is much better for people to charge it at 2 am when demand is very low and the system is not being used at capacity.

We may want people to switch off some of their appliances, not by going around the house and flicking switches, but by having them smart-

enabled so you could run your fridge through the day and then switch it off for a couple of hours in the evening because it had preloaded the cold. You can shift power around like that. So you do want some price signals in the system for retail consumers to enable that, but you also need to ensure that you are not pushing those to the point where people end up not being able to afford to keep the lights on.

The other mechanism is just to buy backup directly through something like a capacity market and just say that we will pay people a retainer, in essence, to ensure that this remains on the system. That is a fixed cost and you have to decide how you are going to distribute it across people, but it does provide a mechanism to ensure that you have a certain amount of capacity that is there when you need it. That challenge exists in any system that needs redundancy. One way or another, you have to find a mechanism and the capacity market does that the moment. Again, you might want to iterate the way you do it, but it is not that such a system is missing.

Q68 Lord Grade of Yarmouth: This is, by any stretch of the imagination, an extraordinarily complex project—getting to net zero in the timeframe. There are any number of constituent parts, any number of competing interests and so on. How do you think this can be project-managed? Does it need an overarching regulator? Somebody has to take ownership of implementation and watch how it is progressing and resolve disputes and all the rest of it. Is that a job for Ofgem or do we need some new net zero tsar with an organisation charged with making sure of the implementation? How would you manage this project to make sure that it runs smoothly? What is the ideal solution?

James Richardson: Inevitably, with any change on this scale you cannot just put it all in one place and say we will have an office of net zero which will be responsible for everything because the task would be too overwhelming. Although it creates co-ordination challenges, it is inevitable that different parts of this will sit with different organisations. Ofgem has a key role to play in regulating electricity and gas networks. That job is not going to go away. We think Ofgem should continue to do that. But, for example, it is the electricity system operator which is responsible for ensuring system balancing. Again, that is a key function. It needs to be managed and it becomes more challenging in this world to run any of these markets that we were talking about a moment ago to ensure that there is resilience on the system and various other system services.

But if you look at heat, it is a much more decentralised problem. You can think about managing the electricity system through relatively centralised organisations such as the ESO and Ofgem, and perhaps distribution system operators, and BEIS. But if we are going to convert every house in the country, somebody will have to visit every house in the country and that is not a function that is very easily carried out centrally, so you are going to need a much more decentralised approach there.

How do you co-ordinate this and get decisions taken? In the end there is no substitute for Ministers and Cabinet committees. Various proposals have been made to try to create more technocratic bodies, but they all suffer from two challenges, as I would see it. The first is that there is already us and the Climate Change Committee providing strategic policy advice here, so it is not obvious that there is a clear gap in the strategic policy advice space.

The other is that in the end these decisions are so important and so political that only Government Ministers can make them. If we are going to tell every household in the country that they can no longer rely on natural gas for their heating and that they have to pick up these alternatives and that they may have to pick up some of the cost of that as well, that is an inherently political decision. You cannot hand that to a technocratic delivery agency and just expect it to get on with it. Ultimately the Government are going to have to take those big strategic decisions and set them out.

Then implementation will look different in different sectors. Some of that will operate very much more through the market; for example, the delivery of electric vehicles. Some of it will be through regulators such as Ofgem and some of it may be the Government acting directly with energy efficiency grants and so on. Although it does create co-ordination problems, I do not think there is any substitute for saying that you need different delivery models for different parts of this. In the end, that co-ordination has to be at Cabinet committee level because Government Ministers are going to have to take these decisions.

Lord Grade of Yarmouth: Forgive me, I am more interested in implementation than I am in the strategy, because once the strategy is settled everybody has to implement it and play their part in delivering it. Some will be hopeless; some will fall behind; some will want to change their spec. There are all kinds of operational delivery potentials for conflict. You cannot keep pushing this up to some political Cabinet committee. Some organisation has to be sitting on top of this and holding people's feet to the fire: "You said you were going to deliver this by such and such. You have not delivered it. What is going on?" The day-to-day operational implementation seems to cry out for some kind of non-political project management.

James Richardson: The question there is whether that is for transforming the entire economy to net zero or whether that is sliced up into component parts. Within the electricity and gas networks you have Ofgem; you have the system operators. They are responsible for ensuring that the companies deliver and for ensuring that this happens. Obviously, BEIS is responsible for some of this as well. You have a set of delivery agencies and you have a set of companies that you are seeking to incentivise to deliver. That system probably broadly works as it is, not without change, but without starting again.

On the heat side there is a much bigger question here because it does need some more decentralised delivery. Clearly, we need the strategy

first. Until we know what the strategy is, it is quite hard to know what the right delivery model is. You have only two fundamental options as to who will deliver a lot of this. The first is local authorities and the other is distribution companies, perhaps the retail energy companies, but it is not clear that they would have the capital base to take responsibility for this because you are going to have to go house to house.

You could conceivably set up a national agency to try to do this but it is inevitably quite a localised issue and I am not clear why you would want to set up a national heat-delivery organisation. You may again want some co-ordinating body that holds local authorities or distribution companies to account, or some mix of the two. It does depend on the strategy that you are adopting because that affects what you are trying to get households to do.

On the energy efficiency side, which is very closely linked, we have again seen that central government's attempts to incentivise households have not been tremendously effective, but local authorities' efforts do seem to be more successful, so a more decentralised approach is probably more sensible.

Lord Grade of Yarmouth: I suppose the central principle here that I am driving at is that every constituent part, every participant in this huge project, needs to know from the outset to whom they are accountable for delivery of what they are required to deliver. That seems to be a prerequisite.

James Richardson: Yes, it is obviously a very valuable principle in any organisation. Ultimately that comes back to: do we have strategic clarity about what we are trying to deliver? We have seen that where that clarity has been given, it has driven changes through the system. For example, the Government's commitment to 40 gigawatts of offshore wind has sent a very clear signal and we now see Ofgem looking at generating a transmission grid in the North Sea and working with the companies to make that happen. It is an essential part of the transformation, but it required that clear strategic "We are going to do this", and then the regulator can get on with it and then investment can come because the regulator has tools that enable that to happen. If you have all of that, clearly it can work. In other areas we do not have strategic clarity and we do not necessarily know who is being tasked with delivering what particulars in heat. I hope that the heat and buildings strategy will help set this out.

Q69 **Lord Burns:** James, I see that you sit on Ofgem's RIIO-2 Challenge group. Can you give us a quick view as to how you think that RIIO price control system works? We notice that it has come under quite a lot of challenge at times, either for being too generous to companies or for running the risk of underinvestment. How far do we need these controls? How much of the heavy lifting in creating the electricity generation capacity can be delivered by competition and how much of it will have to go through this price control mechanism?

James Richardson: Our general approach here would be to try to use competition as much as possible. On the generation side, that is all done through competition. The competition is carefully controlled. It is basically now all CfD auctions, so it is not a traditional free market as we might understand it, but it is still a very competitive process and it has driven prices down very substantially.

We would also see a significant role for competition in upgrading the networks. With something like a North Sea grid, there is no reason why that should just be gifted to the National Grid to build and then have a price control to tell it how much money it can have. A competitive process can be used to do that. Somebody still has to ask, "What do I mean by a North Sea grid?" There are variations in how much of that flexibility you put into the market and allow people to come up with their own solutions to a set of outcomes or how much you design it and then say, "Tell me how much you would charge to build it". There is clearly a scope for more competition there, on the onshore side as well, and it is very welcome that the Government are proposing legislation that would allow that. At the moment it is possible offshore, but not onshore.

We will still need these large transmission distribution networks and they are natural monopolies. At the end of the day, regardless of how much carbon is involved, electricity will flow only from a generator to your home or office through a piece of copper cable and it is going to flow only through one and not through multiple competing cables. You do need something like the price control to ensure that the price for that is set in a broadly fair way that incentivises the investment that is needed in those networks and that manages the maintenance and cost capital of that, but at a reasonably fair rate.

What is our sense of how effective that process has been? Broadly speaking, it has achieved the objectives that were designed for the model of economic regulation in the 1980s and 1990s when this was invented. It has enabled large-scale investment. While this was not such an issue in the energy system when it was privatised, it was a very big driver, as you also know, of privatisation in telecoms and in water and the regulation system has been pretty effective at bringing forward investment there.

Of course, everyone will always argue that the cost of capital is either too high or too low, depending on which side of the argument you are on, but I do not think there is any evidence that suggests that it is wildly wrong. No doubt any individual decision by any individual regulator at one time is not perfect; it never can be. With the benefit of hindsight it is fairly clear that a lot of the regulatory settlements not just in energy but in water were set quite generously last time, because essentially regulators did not foresee the very long period of low interest rates that we have seen—but then nor did a lot of other people. Now it is being brought down and everybody is complaining the other way.

It is hard to say that these costs have been set punitively either way or that anybody else would necessarily have done a better job. If you expect your regulators to be perfect, you are always going to be disappointed,

but the basic system is there. We do think there needs to be a clear signal from government to the regulator that net zero is part of its job. In fairness to Ofgem, it is acting as if it is anyway, so I do not think this lack is causing any problems, but it would be open potentially to challenges in the future from people who might ask, "Why are you loading these costs on to consumers for this political objective?" We do think that that will help clarify the need to deliver investment for net zero, but, as I say, I do not think Ofgem is acting any differently than if it has this at the moment.

The Chair: Thank you very much indeed. James, thank you for your contribution today. That brings this session to an end.