



# Industry and Regulators Committee

## Corrected oral evidence: Ofgem and net zero

Tuesday 7 September 2021

10.25 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. 5

Virtual Proceeding

Questions 55 - 63

### Witnesses

**I:** Chris Stark, Chief Executive, Climate Change Committee; Mike Thompson, Chief Economist, Climate Change Committee.

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## Examination of witnesses

Chris Stark and Mike Thompson.

Q55 **The Chair:** Good morning and welcome to the Industry and Regulators Committee's fifth oral evidence session on Ofgem and net zero. Our first panel of witnesses today are from the Climate Change Committee: Chris Stark, the chief executive, and Mike Thompson, the chief economist. I would like to go straight into questions.

In the sixth carbon budget you estimated that all investment costs to reach net zero would be £50 billion a year until 2050. What were the principal assumptions that you used in arriving at that estimate? In particular, how much of this relates to energy decarbonisation?

**Chris Stark:** Thank you, Lord Hollick. I am grateful for the opportunity to speak to you this morning. I am speaking to you from Glasgow remotely today.

On the estimate of the costs of net zero, you are right to say that we have recently done a lot of work on the economics of this transition and the costs of it too. Briefly, to explain the logic of what we said in our most recent report in December, a central view is that the transition to net zero emissions will involve a lot of new investment across the economy in physical assets over the next three decades. That is the technologies and the infrastructure that we will be using to supply low-carbon energy and of course the devices that will then use it.

In our modelling, UK low-carbon investment each year increases from around £10 billion per year in 2020 to about £50 billion by 2030, as you said, Lord Hollick. Most of those investments will be made by the private sector, businesses and individuals. Extra investment at that kind of level would add about an eighth to total investment in the UK, if we look at the pre-pandemic numbers, by the time we get to 2030. This is a big number.

We have seen scale-ups of that order in some sectors, but I suppose the challenge is to scale it up across the economy in an integrated way. Much of that will rest on new policies and new signals from the Government. In our modelling, we are progressively replacing the capital stock of the whole economy largely in line with normal asset replacement timescales as much as we can so that we have this orderly transition from high carbon to low.

It is important to say that it is more than just investment cost that is going on here. Much of the investment spending will be recouped through lower operating costs using those assets. An electric car, for example, is cheaper to run because it is more energy efficient. The fuel for it is low-carbon electricity, which becomes cheaper over time in our modelling. Those savings, which relate partly to those energy efficiencies but especially to a reduced reliance on imported fossil fuels, also change over

the course of the transition to 2050. The savings rise to about £35 billion by 2035 and to £60 billion per year by 2050.

That gives this aggregate position of the investment costs, the ongoing running costs of the assets and also the costs of the financing of those investments, which we total up and we can express as a proportion of GDP, which we sometimes call the resource cost. We estimate that that is now less than 1% of GDP throughout the next 30 years. That is lower than we estimated in 2019 when we did this work looking at net zero. It is also lower than the 1% to 2% of GDP that we estimated back in 2008 for the old 80% emissions reduction target, which was superseded by the net zero target. That is the broad sense of how we have done it, Lord Hollick.

There are other benefits too, which we have not tried to price in or to wash away, that are likely to take this into a net positive territory for the economy: the health benefits, the innovation benefits, the industrial opportunities that come from this transition, potentially the boost to GDP that comes from making the investment over the next 10 years or so and also the GDP boost that comes from bringing back activity to the UK that we presently import. There is a strong story overall in aggregate.

I would like to bring Mike in briefly to say something about how we pulled this together and some of the assumptions that we made along the way. Mike.

**Mike Thompson:** Thank you. Yes, Chris has neatly described the way that we have done it. We have focused on the investments that you need to make to be low carbon instead of high carbon—for example, a wind farm instead of a gas-generating plant or an electric vehicle instead of a conventional vehicle—then we spread the cost of those investments across their lifetimes.

We allow a return, a cost of capital, on those investments and that cost of capital is a pretty important assumption. We do not have a single cost of capital that we use across the economy. We tend to use a lower one for households and a higher one for business investment. That reflects that generally businesses are able to make alternative profitable investments so that if they invest in a low carbon thing, perhaps you are crowding out another profitable investment, so you use a higher cost of capital there and spread the cost over the lifetime.

The other key thing then is the running costs of those technologies. Lots of specific assumptions are embedded in there around the efficiency of each technology. Again, that will be different for every different sector of the economy, every different low-carbon technology and every different high-carbon technology.

There are assumptions then around the fossil fuel costs and what it would cost to purchase gas and bring it into the UK over the period to 2050. We have used the Government's projections on that. The Government publish their projections of fossil fuel prices and we have used those. They have a

range. Some are lower; some are higher. No one knows what those will be in future, so we have played with this across the full range of assumptions that the Government publish.

Then in terms of the cost of electricity going forward, we do that based on the underlying cost of the technology. Again, the Government have put out their projections for what offshore wind and nuclear will cost in future and we use those costs to plug into our analysis. If offshore wind costs X and gas generation costs Y, that tells us about the relative cost of electricity in a low-carbon world.

Essentially we do that across the whole economy, we add all those up and that gets us to this overall cost on an annualised basis. We have a central estimate of around 0.5% of GDP, but given those uncertainties over fossil fuel prices, technology costs, et cetera, we have said that that is best understood as a cost of under 1% of GDP. It might be very close to 0% or it might be as high as 1%, but it is certainly small and it will not be much larger than that.

**The Chair:** Thank you. Sticking with decarbonisation, which you are aiming to achieve in the plan by 2035, what are the particular costs relating to decarbonisation? How do you expect those costs to be funded in terms of attracting investors? Investors will be looking for a menu with prices on it, rather than a menu without prices. How will you answer their questions and give Parliament in particular and others the opportunity to dig into the assumptions on costs? Let us focus particularly on decarbonisation.

**Chris Stark:** Of course. You asked about energy decarbonisation. A great deal of the total investment requirement we have just talked you through is indeed in the energy sectors, but it is important to say at the top here that it does depend where you draw the line on energy. We can describe most of the costs and investments here and indeed most of the savings as energy savings and costs.

Crucially, there is the investment in the electricity supply sector, which—as you have said, Lord Hollick—we are clear in our modelling could be fully decarbonised by 2035 if of course the policies are put in place to make that happen. That is in our central estimate of the costs. A great deal of investment is required in that sector. Most of it though is at the kind of level we are already doing. We are talking about investment in the order of £15 billion per year by 2030. After that, it comes down.

There are also the energy networks. Mike can correct me, but that is about £5 billion to £10 billion per year. Again, it is more like a one-off cost. We are reinforcing the energy networks to allow this transition to take place. There are other costs in there too. Decarbonising the fuel supply you could describe as an energy cost. Again, investments there are less than £5 billion. Then there is a set of other costs. I will not go into in detail, but they are also related to this energy transition: the investment we need in buildings, in decarbonised heat, industry, carbon capture and storage, and also in transport with all the charging

infrastructure, electric vehicles, for example. We have tried to look at it in those terms.

Mike, would you like to say something about energy specifically and how we have looked at it and perhaps move on to some of the questions of policy that might be needed to drive that kind of transition?

**Mike Thompson:** Yes. The assumption we have taken on the electricity side specifically is that the Government continue to offer contracts for difference. The bulk of the technology, we assume, will be brought forward by the Government offering contracts that may pay back if gas costs end up higher. They may get a top-up if gas prices go very low. That has worked pretty well so far. It has been attractive to investors. We have seen billions of pounds coming in through that system. Again, we used the Government's assumptions around what the costs of those are likely to be in the future and tested a range of uncertainty around that. Of course, no one knows what an offshore wind farm will cost in 20 years either. That is the central assumption for the bulk of generating capacity.

There are also lots of other bits that you need alongside it. As Chris said, the networks are quite an important bit of that. We have assumed that the networks are paid for under the Ofgem regime, so those get a regulated return rather than the higher return that you would expect for a private investor in the generating capacity.

Additionally, there is a question around the flexibility at the edge. You need to provide a lot of generation, but of course you also need to be able to match that to demand. We know that challenge is different as we invest in more intermittent technologies such as wind and solar. You need to invest in those things as well. Those will probably have a different regime. It is fair to say we are less clear about what that will be at the moment. Particularly hydrogen will be important in that. We have now the hydrogen strategy from the Government, but there are still questions around how we will fund and how we will bring forward the investment in those flexibility options at the margin, in particular hydrogen, to provide back-up capacity to provide generation at the peaks and generation when the wind is blowing less.

**Chris Stark:** Given the scale of the investments required annually, an important aspect of this is the importance of good policy-making to drive investment in a low-risk way for investors so that we get a low cost of capital. That can be quite a significant part of the cost if it is managed in a way where we do not get that certain return for investors. That speaks to the kind of policy we have had in place, recently at least, for the renewables sector contracts for difference.

**The Chair:** Hinkley Point C does point up some of the difficulties of contracts for difference at 92.5 pence a therm. That will inflate the level of inflation. That is one cost that is marching up. You have presumably made the assumption that the Government will be able to have contracts for difference to encourage investors to invest at ever lower rates. Is that a realistic assumption?

**Chris Stark:** We have made a set of assumptions about a range of costs of technology. You are right to say that we have assumed some falling costs in energy technology, but I would not say they are significant. We are not assuming, for example, radical shifts in the cost of offshore wind. We are assuming a 20% reduction in the cost of nuclear. The point is it could be quite resilient to a higher cost if that was necessary. We have not made an assumption that CfDs will be in place in perpetuity, but we have taken at least a transparent and measured view on what kind of cost changes we will see in the future from these key technologies.

Q56 **Baroness Donaghy:** Good morning, Chris and Mike. My question is about unknown technologies. When I looked at the question, I thought, "I do not know who will be able to answer that if it is an unknown technology". A Chatham House report argued that the Government's net zero plans are overreliant on carbon capture and storage, and biomass. I am sure there are lots of other uncertainties. You referred to electricity; you referred to wind farms. I am trying to get the bookies' odds on all this. To what extent do the predicted economic benefits of the net zero transition rely on these unproven technologies or these halfway-developed technologies?

**Chris Stark:** The short answer to your question is not overly. The longer answer is we have thought hard about this issue of technology choice and the extent of unproven technologies. It is important to say that we have tried to create several different pathways in our technical modelling to net zero. We did that deliberately to illustrate different approaches that were possible to the transition that is ahead of us. It will be for Ministers to decide which of those choices they wish to take and to follow. Of course, we have not yet seen the strategy from the Government and that will be an important moment.

In our work, we wanted to illustrate how the transition could play out, including the change in technology that we would see. We have, for example, a pathway to net zero that leans more on behaviour change and changes in consumer preference. Another one looks at technological innovation and tries to explore a little what would happen if we saw more of that technological innovation take place, especially if we saw cost falls in some of the key technologies.

The upshot of that is it is clear there are lots of choices ahead of us here and we do not know exactly what technologies will be deployed and developed over the next 30 years. It would be daft to say that we know, but the lesson of the last 30 years is that we know there will be lots of technological development, but we do not need it. It is important to say this. We have tried to rely on technologies that are known today, although not perhaps developed at large scale yet.

We try to think ahead in the work that we do and our modelling. We try to spot the opportunities for costs to come down, particularly with scaled deployment of the key technologies. We were long advocates of offshore wind, for example, because we could see the opportunity for scaled

deployment and cost falls. We did not quite predict the extent of those cost falls, but we could see the opportunity there.

We do include technologies such as carbon capture and storage. In our modelling we couple that with bioenergy and the potential there to use a crop or a forest residue in an energy process, capture the carbon and store it, which does create negative emissions, but we are not overly relying on those technologies. We are also deliberately including some of the more speculative technologies like direct air capture, but they make a very small contribution in our modelling overall.

The key thing to say in response to your question is that we have ruled out basing this assessment on any exotic technologies. That is not to say they will not come; it is more that we do not need them. The lion's share of the work is very much being done by well-established technologies. I made this point a few minutes ago. We are not making wild assumptions about changes in the costs of those technologies over time either. We assume conservative estimates for those cost falls. Overall, that gets us to net zero in a way that we think is credible.

If those new technologies were to come along, then of course that would help, were they to be cheaper. Again, this is part of the story, I suppose, of us being more confident with each passing year that net zero is an achievable outcome. If those technological improvements come along as they have over the last 30 years, then I hope that will allow this to be achieved more cheaply and potentially more rapidly.

**Q57 Lord Sharkey:** Good morning. My questions are to do with the consequences of delaying or not taking actions required for the transition to net zero. At what point do delay or non-action generate non-trivial consequences? What are the potential economic costs of delay or non-action? Perhaps you could give us some idea where these costs might chiefly lie and some sense of their possible scale.

**Chris Stark:** Thank you, Lord Sharkey. This is absolutely at the heart of why we need to tackle climate change itself. It is worth saying at the outset that there is a central piece of economics here. We can look right back to Nick Stern's review, *The Economics of Climate Change*. It has been clear for some time that the costs of inaction will dwarf the costs of action on climate change.

We have not tried to put a single number on the physical costs of unchecked climate change because they are so self-evidently huge. Think of just the cost of extreme weather and storms, for example, even in this country. It is hard to reliably put a cost or a price on that. Also the effects of climate change elsewhere trigger expensive outcomes for us here in the UK. There is a large cost here that we are seeking to tackle with pre-emptive action. It is not just us who have said that; it is not just Nick Stern. The OBR has said that as well in its recent work looking at the economic costs of a poor outcome on climate change. It is very clear that it is worth trying to mitigate it.

Perhaps I might turn to my colleague, Mike, who can say something about specifically the costs of inaction here in the UK on net zero. That ultimately is the critical question and we have looked at that question quite hard. Mike.

**Mike Thompson:** Thanks, Chris. This is one of those that we have thought about a fair amount, but it is very difficult to quantify. It is hard to put a number on it. The effect depends on how much delay and where the delay is. We have identified four broad transmission mechanisms that will lead to added costs from delay. One is that you make more mistakes by delaying. You are more likely to invest in high-carbon capital that you then have to scrap later or maybe you have to costly retrofit. A good example of that is homes. We have been building homes that are not low-carbon homes and that we will have to retrofit. We know that it costs more to put in low-carbon heating and to make homes energy efficient after they have been built rather than doing it when they are built. We think that is maybe £1,500 to £5,500 per home of extra costs. We have built 1 million homes over the last few years, so you can quickly scale that up. It is billions of pounds of extra investment that we will have to make because we have delayed bringing in a policy to make new homes low carbon.

You can extend that across the rest of the economy. If we keep investing in petrol and diesel cars instead of electric cars, we may have to scrap those before the end of their natural lives and that will add costs. That is one: you make more mistakes and you invest in the wrong things and have to scrap them early.

The second is that you miss investment opportunities. Particularly at the moment, with the need to recover from Covid to get the economy going again, there is an opportunity to have investments in the near term that boost the economy and speed up the recovery. Those could be investments in renewable energy capacity or they could be investments in decarbonising homes and making them more energy efficient. These investments are often in parts of the country that need help recovering. They are often spread around the economy and are quite labour-intensive, so they are well suited to boosting the economic recovery. If we delay action, we miss out on some of the opportunities to boost the economy and get people back to work.

You also risk introducing more uncertainty. Business at the moment is behind the net zero trajectory. It is planning on the basis of scenarios that look like the Climate Change Committee's scenarios. If you start to say that we will delay this or delay that, you introduce an extra element of uncertainty. It goes back to the point Chris made. You increase the cost of capital as you add risk and then potentially you increase costs across the whole economy.

The last one is that you potentially miss out on global opportunities. We know that the world is increasingly moving towards net zero. Net zero as a target for mid-century is now covering over two-thirds of global GDP. That is a huge market that you can tap into if you are at the front of it. If



you delay, potentially you can get behind other countries. Hydrogen is maybe one that you would look at there. Europe is putting a lot of effort into hydrogen with a big strong strategy there. If the UK does not move fairly quickly as well, it becomes hard to imagine that we will capture a good part of the value added of that potentially huge future technology and future market that there will be.

**Q58 Lord Reay:** Gentlemen, good morning. Can you please explain how the CCC expects the public—not to mention parliamentarians—to find credible the net zero cost estimate of 1% to 2% of GDP by 2050 or earlier, as you were mentioning just now, when considerable time and taxpayer resources have been expended by the organisation in opposing requests to disclose the financial calculations beyond the costings, only for the CCC to admit recently that the financial models do not exist?

**Chris Stark:** I would reject that accusation. The models certainly do exist and indeed we have published them. You are right to say that we received a request to release the working spreadsheets that sat behind our 2019 net zero report and we were not keen to put out working spreadsheets in their unrefined form because we felt they were misleading and difficult to interpret. We have now published them and they reveal the extent of the work that happens in the CCC on a regular basis to try to understand some of these cost issues and the depth of the analysis across the piece in looking at the challenge of decarbonisation and how it can be managed. Those spreadsheets are out there and they are difficult to interpret.

We work hard in all our published work to make our analysis transparent and easy to understand. You can see that in the 2019 report and you can see that particularly in the work that we have done since 2019 to look at the transition, the costs of the transition and the steps that would be necessary to get to net zero across the economy. We went the extra mile in last year's report in December to try to put out a transparent set of data as well as a set of reports, which can be used and interrogated by anyone who wants to understand how we have approached this challenge. I am happy with the work that we do in the CCC and of course I am extremely happy to discuss how we have arrived at our conclusions.

**Mike Thompson:** On this question of whether the costs are credible, it is key to look at the costs of individual low-carbon technologies compared with high-carbon ones. We can look at offshore wind; we've signed contracts to bring offshore wind on at £40 a megawatt hour. We know that gas generation costs are quite often probably higher than that, so we know that we can generate low-carbon electricity as cheaply as we can generate high-carbon electricity—potentially more cheaply. We know of course as well that that cost has come down from well over £100 per megawatt hour not so long ago. We have this strong downward trajectory. We can see that in electric vehicle batteries, for example, as well.

In other places where we have invested in these new technologies and what we see in technologies across the world, whether low carbon or high

carbon, is that as you invest in things and as you scale up, markets get better at doing it and the costs come down. We are at a point where we already see that the key technologies here are about electrification and low-carbon electricity is absolutely at the heart of the transition. It can be generated at the same price as the high-carbon things. The bulk of the problem does not have a cost attached to it.

Of course there are bits at the edges. There are the networks. There are things that need to be done alongside that as well, which is why we do not end up with a zero cost. But again, if you look at even the difficult bit, the heating part of it, which is one people often focus on, let us say you think that will be £10,000 per home. That sounds a lot. We have 25 million homes. If you scale that up, you are at £250 billion. That investment programme is spread over 25 years and so is in the order of £10 billion a year. That 0.5% of GDP is a £20 billion a year cost. It should feel intuitive that these are the right sorts of magnitudes. We have big bits of the problem where there are no added costs, we have big bits such as electric vehicles where there is every reason to think in the long term there is a saving, and when you tot up on a simple basis the cost of the expensive bit, it is in line with the overall estimates we are talking about.

I hope the simple calculations give credibility to the assessment overall. As Chris said, we have also published the incredibly rich detail behind it because these are not simple calculations. These are also very detailed ones, but they stack up whichever way you look at it.

**Lord Reay:** What are the potential transition costs for businesses and individuals in the particularly affected areas of the economy and how should these costs should be borne?

**Chris Stark:** We have talked a lot about the aggregate position, Lord Reay, which, as Mike says, is coming into view now and looks manageable, especially if we act quickly. But there is no sense trying to duck this. There are real costs in some areas of decarbonisation. There are also real benefits in others. Crucially, those costs and those benefits are not spread evenly across the country. They are not spread evenly across income distribution, nor are they spread evenly across the economic sectors. For me, we have this aggregate position, which in our assessment is comfortably less than 1% of GDP, even when we assume some error around that, but the aggregate position means nothing to those who bear those costs directly.

For me, this is so interesting because this is a classic challenge for fiscal policy and a challenge for tax reform. We will need these distributional impacts to be considered carefully by the Treasury. I hope we will see some thoughtful fiscal reform in this area to help manage it. That is the promise of the Treasury review into the funding of net zero, which has not yet been published, but has been under way now for a couple of years.

The areas where we see the biggest costs are in decarbonising buildings and decarbonising manufacturing and construction sectors and also fuel supply sectors. The costs here are substantial, so we would be talking £15 billion per year for buildings perhaps and £5 billion for industry. Those are significant. There are also significant savings in other sectors, notably in decarbonising surface transport and also in electricity supplies after the 2030s, in our assessment.

It is an interesting challenge here perhaps for the Treasury to try to recoup some of the savings in some areas to help protect vulnerable consumers, be they in industry or individuals, from some of those costs of decarbonisation. I do not dismiss the challenge here. It is easy for me to say what the costs look like in aggregate; it is easy to talk about tax reforms. It is fiendishly difficult of course to construct policies that can tax pollution and that can avoid the regressive impacts of all this.

However, there is a role for a mixture of policies here. It is not just about tax and spend as a mantra. Some of the poorest in society will also benefit if we can drive the pace of the transition towards the cheaper things; for example, cheap electric cars and better public transport. Big savings are to be made for consumers from those transitions if we get those right and also big savings from the more standard outlook on this, which is to drive better energy efficiency and improving the fabric of buildings. Those sorts of things will have a real benefit to the people living in those buildings as well.

This is why we regularly talk now about the importance of seeing the Government's strategy in the round to understand how these things will be integrated. It is important. We should see the net zero strategy, I hope, in the next few weeks from the Government. That will be the first time we have had a real understanding of how they see these integrated challenges playing out. I hope that that is a strategy that has the clear endorsement of the Treasury and the Chancellor. If it is accompanied by those fiscal policies I talked about, with a strong sense of the principles that the Treasury will deploy in looking at the public spending challenges and the tax challenges, then we should have something that looks much more like a holistic integrated plan for achieving full decarbonisation, which is entirely possible. I hope we will see that soon.

**Lord Reay:** In its net zero report, will the Treasury be using your financial calculations? What are the greatest downside risks to your cost estimates of net zero?

**Chris Stark:** I will bring in Mike in a second. We have worked with the Treasury. I do not know whether it will use our numbers. I suspect the Treasury will develop its own outlook on some of that. Of course, the key challenge is not just the quantum, it is also the question of how it is distributed. The Treasury has much better analytical capacity on the distributional challenges than we do in the CCC. Mike, would you like to pick that up?

**Mike Thompson:** In terms of the downside risks of the costs being higher, the big one we have looked at is fossil fuel prices. What if gas prices or oil prices are very low and we have moved away from using gas or oil? We think that would add around 0.5%. The central estimate of 0.5% would become a 1% of GDP cost. It is important to remember that you have missed out on low costs rather than facing high costs, in a sense. In terms of the pressure on household budgets, you might think about that slightly differently if the technology costs were higher, of course.

The other downside cost is about getting the policy wrong and the approach we take to this. We are too slow in producing new policy. We produce policy that flips and flops and changes and adds investment costs for investors. We end up with everything being more expensive than it should be. That is probably the biggest downside cost. We will not get everything absolutely perfect and we do not assume that everything is perfect, but the challenge is to make sure that we do things on a timely basis, we do things that involve the full chain of the community, from investors through to developers through to consumers, and we make sure that the system works as we develop it. That is where you are most likely to get things wrong and add costs. Again, potentially it is hard to put a number on that because what do those mistakes add up to? But certainly if you are increasing the costs of capital by a few percentage points, then you can add that and that 0.5% of GDP can get to 1% quite quickly through that route.

Q59 **Baroness Noakes:** I would like to shift to energy prices and energy bills. You talked about the effect of all these policies not costing very much by the time we get to 2050, but of course that is not an even path and there will be significant additional costs in the early years. One possibility is that there will be so-called fiscal policies, otherwise known as taxpayer subsidies, to do this. But assuming that there are not significant additional public expenditures made available, given the considerable other pressures on the public finances, a lot of these costs will end up via energy bills, which are already high by European standards and already make a lot of British business quite uncompetitive.

Assuming that there is no massive taxpayer largesse to bail out the costs of this—and we need to focus on the first 10 to 15 years or so—what will the impact of your costings be on energy bills for individuals and for businesses?

**Chris Stark:** Thank you, Lady Noakes. Again, we are required to look at this issue by the demands of the Climate Change Act. The provisions of the Climate Change Act include one that says we should look at the consumer impact and we have tried to do that as well in our most recent publication back in December.

It is worth recapping on one thing that Mike said earlier. Our cost estimates use BEIS's central values for future gas and oil prices and there is a range. Importantly, we measure cost based on a counterfactual: what would happen if we were not trying to tackle climate change? If

fossil fuel prices turn out to be at the lower end, then the relative costs of decarbonisation will be higher. We have looked at the sensitivities here. Mike has covered it well. They still sit well within that envelope of 1% to 2% of GDP that Parliament debated and discussed in 2018 when signing up to a lesser target. Again, I am not dismissing the challenge here, but overall, in aggregate, the transition does look manageable.

**Baroness Noakes:** Sorry, I am talking about the impact on individuals.

**Chris Stark:** I was going to come to that. You are quite right. Coming back then to energy bills rather than prices overall, Ofgem estimated that the annual bill for a dual-fuel household is just over £1,000. That was back in 2019. That is going up, as you have mentioned, Lady Noakes. Around £150 of that bill is already attributed to the environmental and social costs of decarbonisation. That is a regressive impact. By 2050, as we have discussed extensively this morning, we do expect that the combination of the investment costs plus the operational savings from our scenarios would bring the cost down, but, as you say, it is a transition. Until the 2030s, we do expect low-carbon electricity investment at least to continue to add costs to energy bills. This is a difficult moment for that to happen. We can expect energy efficiency to offset some of that, but there are real costs there.

That is mainly about three things, if I can cover them very quickly. It is the cost of the network reinforcement, which is necessary for all those changes in generation that we have seen and of course is recovered through the energy bill. Most of that is done through the UK's regulated asset base. Many of the costs are already committed to, so we are already in that position where network costs are rising.

We also have legacy costs from renewables contracts that were signed a while ago, at a time when the price was much higher. We do in the future have new nuclear coming on, which is at a higher price than renewables, so that will add. Potentially we also have things such as carbon capture coming on and the cost of hydrogen, depending on what the Government choose to do with that. From the late 2020s, the third element of this is that the costs of legacy low-carbon investment start to come off the bill, reducing costs quite significantly. Those three things act in concert. We do predict that under the current policy arrangements, until about the 2030s bills will go up, then after that start to come down.

**Baroness Noakes:** By how much? It is important because the public acceptability of these policies will depend crucially on whether or not the costs are regarded as bearable by the public at large.

**Chris Stark:** I am afraid I do not have a figure for that. Part of the reason I do not have an answer to that is because I do not know what the Government's policy is. The extent of costs here in decarbonising some of the sectors of the UK economy will depend ultimately on the Government's approach.

My final point to make on this is that it does not have to be this way. I am talking about a position where the Government's policy on bills does not change. It seems to me that is very unlikely. One of the lead options to avoid that regressive impact that we talked about is to move some of those costs potentially from the consumer bill to general taxation—you covered that in your question—but there is still an option for the Chancellor to do some of that.

Another policy, which would be a very strong incentive, would be to change the mix of costs on that dual-fuel bill so that crucially the costs of decarbonisation are moved from electricity bills towards fossil-fuel bills. The fact that with those policy costs at the moment we are making the costs of the thing that we want people to use—the clean electricity—more expensive is counterintuitive, to say the least.

There are options here and I hope the Chancellor is thinking about those options because it is an important aspect of the transition ahead. It is difficult for me to appear before you without an answer to that question because I would like to know what the Government's policies are across the piece here. The consumer aspect of this is absolutely central to the success of the transition overall. Mike, do you want to add anything?

**Mike Thompson:** We did put some very broad-brush numbers in our sixth budget report on this. We expected that the investment costs of the low-carbon generation would be in the order of £9 billion a year extra by 2030. We think that will typically add a little over £100 to bills. Also, as Chris said, on the other side of the ledger we have improving energy efficiency in that period as well, which we think will take off about £100. We have not calculated how the wholesale gas price plays out as well. I would expect over that period what happens with gas prices will still be the predominant driver of what happens to people's bills. The changes we are seeing into this winter, for example, are about gas prices more than they are about the other bits. I would expect that to continue to be the case through to 2030.

In a way, the period in the longer term out to 2050 we can be more confident about. It seems strange to say that for a longer time period, but because we move away from reliance on imported gas to 2050 and we start to be more reliant on UK-based low-carbon technologies where we are signing contracts for long periods and the prices do not fluctuate as much to 2050, we are more confident about the bills then starting to come down again because we are doing that based on a market that is a bit more predictable in terms of its prices.

**Baroness Noakes:** I do not think 2050 has anything to do with the acceptability in public terms in the short and medium term. Anyway, thank you.

Q60 **Lord Blackwell:** I would like to hear a bit more on the costs and who pays for all this. First, when you talk about the cost of 0.5% to 1% of GDP, does that include the expected investment that households are required to make in converting to hydrogen boilers, installing heat pumps

and so on?

**Mike Thompson:** I should have been clearer, sorry. It includes absolutely everything. It includes the cost of converting in the households, it includes the costs of the charging networks, the network strengthening and the energy system to deliver the services as well. Everything is included. We strip out anything like taxes that are transfers between different bits of the economy. We strip all those out and we focus on the pure costs, if you like.

**Lord Blackwell:** In terms of costs to households, part of it is what happens to the electricity bills, but we are potentially asking them to incur capital costs if those are not funded in some way. Have you looked at the relative benefits of investment at the household level versus more investment to provide cheaper electricity at the generator end? In particular, I wonder about heat pumps, which are a very significant cost. Is it economic to put the money into lots of people investing in heat pumps as opposed to putting the same amount of investment into creating more green energy and supplying cheaper electricity?

**Chris Stark:** That is such an interesting and excellent question. This is exactly the kind of thing that we think about a lot. I do not have a crystal ball, so I do not pretend to know exactly what will happen over the coming years, but we can say something about the relative mix of costs and what it would be sensible to do. At the heart of the transition that we have advised on, at least for the UK, is this idea of a fully decarbonised electricity system, which increasingly is using renewable electricity as its basis. By 2050 about 80% of the electricity being consumed is renewable, in our assessment, which is cheap electricity. We are also doubling the size of the electricity system.

There is a basis for decarbonisation that we do not yet have, although I would say the UK has gone further on decarbonising power than most large economies, but that of course opens up the option then of using that electricity in ways that we do not today, particularly for heat and also for transport. Potentially at least—and it comes very strongly through in our analysis—that will be cheap electricity. To me, that is a big part of the excitement of the transition that lies ahead.

In terms of what the right mix of costs might be though, bill payers versus taxpayers perhaps, and what costs should be borne by the individual versus the state, it is quite difficult for us in the CCC to say what that is because of course this is where the politics comes in. Ultimately the question of public spending versus private spending too often ignores the fact that in the long run it is all the same people, so in the end these are real costs that will be borne somewhere.

The question is how we can do that in such a way that we minimise the cost to those who cannot afford it. That question of fairness is now key. If you accept our analysis that even with a poor outcome for net zero the costs are relatively small to the economy, then the question is not so much about the quantum of those costs. It is about who experiences

them directly, how they are spread in a way that is fair and how they are done in a way that is seen to be fair, I would say.

It is very important to say this again: while we expect additional investment in the order of £50 billion a year to be necessary, most of those investments will be funded and delivered by the private sector, I suppose helped along by the policies that might steer that investment. In many areas we already have those policy instruments in place to guide that investment and it is often to the betterment of the wallets of consumers that we have those policies.

There is still a need for public spending to make this a less regressive transition and protect consumers—not just individuals but corporates—from costs that they cannot bear directly. We have identified what we regard as a central need for Exchequer funding of between £9 billion and £12 billion extra per year by 2030. That is entirely up for discussion and debate. This is the kind of thing that the Treasury will need to think about. That would be an increase of about £5 billion per year of direct Exchequer funding on decarbonisation. That is what we see spent today. That gives you a sense, in our analysis at least, of the quantum of extra public spending that might be necessary. As we have discussed, spending through low-carbon levies and energy bills would also increase, although that is another option for the Government to set aside if they wish.

When we think about the quantum of costs of that order, £9 billion to £12 billion, and think about the pandemic impacts, I am personally struck by how that small that is as a step to fully decarbonise a major economy. But we will shortly see, I hope, from the Treasury what it thinks about those issues.

**Lord Blackwell:** Thanks. Can I be clear then that you are assuming within that estimate of additional government spending a subsidy for the capital costs that households might incur?

**Chris Stark:** Yes, in some areas, particularly in buildings, where you have real costs. We talked earlier about investment being offset by the savings from using the assets. You still see that in buildings but the capital costs are very big. We are talking about making buildings more energy efficient and also then installing new heat technologies. I would expect that the Government's policy here—and we may see this very shortly in their new heat and building strategy—will include some sort of capital support for the investments necessary at household level.

**Mike Thompson:** In essence, the £5 billion is a calculation to say what the Government would have to spend each year to do the investment programme without adding to household bills and without pushing up costs for industry that could be exposed to competitiveness issues. Doing those two things will be about £5 billion a year.

**Lord Blackwell:** There must be a choice here. If the hydrogen programme succeeds, converting boilers to hydrogen or installing new hydrogen-compatible boilers ought to be a relatively modest capital cost



compared with the cost of installing a completely new heat pump system. Have the Government explored the relative return on that kind of household capital expenditure versus putting more money into creating green hydrogen from surplus wind power?

**Chris Stark:** You may well be right, Lord Blackwell, and that is one of the uncertainties here. The alternatives to hydrogen are things that we understand and know about already today, such as heat pumps. There is potential to bring down the cost of heat pumps, but we understand that technology. Hydrogen as a technology, although we understand how it could work, we have not yet seen proved at a domestic city-level scale.

Potentially the recipe there is to have a more hydrogen-based heat system in this country. We need to be confident that it can be done safely. We need to be confident that the distribution system underneath our roads is ready for it. We also need to think about the national transmission system that would go alongside that and of course the supply of hydrogen too. There are costs at every stage of that transition, costs in the households as well, but we recognise the potential for it.

One piece of advice that we gave back in December is that we felt it was sensible for the Government to make a small change so that new natural gas boilers installed from today or at some point in the near future can be made ready to be switched over at some stage in the future to hydrogen, if hydrogen comes through as a strongly positive new fuel source in this journey. Again, it is difficult to make confident predictions about that. I can say though that the enormous energy efficiencies that come with using heat pumps make them very appealing, given we are confident that we can build a low-carbon electricity supply system for the country. Hydrogen will need to play against that and compete and we have already seen from the Government in recent weeks a hydrogen strategy that points towards an interest in the use of hydrogen at an industrial level and potentially at a domestic level too. This decade will determine whether or not that will be a real part of the change.

**Mike Thompson:** We did explore this space. Chris mentioned that we had a few scenarios for how to get to net zero. Some were very reliant on heat pumps; others used hydrogen instead and switched over the gas supply. You are right that heat pumps require you to make a lot of investment at the household level up front and then you benefit from using cheap electricity very efficiently.

A hydrogen one avoids that investment programme, but you have to produce an awful lot more energy because if you are using green hydrogen, you convert the electricity to hydrogen and you have an efficiency loss there. Then you use the hydrogen in a boiler, which is typically 90% efficient, rather than a heat pump, which could be 300% efficient and draw energy from the air. You gain from a smaller investment programme, but you end up with higher running costs. If you annualise those and you put them together on a comparable basis, there is not necessarily that much to choose between them, given what we know at the moment.

It is absolutely right that the Government are following this twin-track approach. We try to get the heat pumps in so that if that works well and if those costs come down we can have a serious heat pump programme, but we also explore whether we can produce hydrogen cheaply and can make that work as well so that we have those options at play. We can choose the cheapest. Going back to how to keep the costs down, that is absolutely the right way to do it: spend a bit now to make sure we have the options and choose the cheaper thing. It has worked for renewables and we should do that in heating as well.

**Lord Blackwell:** Yes. The role the Government play in subsidising any of this does have a significant impact on the costs that households may need to bear in the short term.

Finally, back to Baroness Noakes's question about what will happen to bills, I was doing a back-of-the-envelope calculation. If in 2019 £150 of the average bill was for green and if you are saying the cost of the net zero programme could go from £20 billion up to potentially £50 billion, which is multiplying by two and a half, would I be wrong to think therefore that the £150 could go up to £400 if there were no government subsidies?

**Chris Stark:** We would need to run the numbers on it. I think it would be lower. Mike talked about an extra £100, for example, because we would not be incurring in the future many of those early costs that are currently on the bill. We have seen dramatic falls, for example, in the cost of offshore wind and onshore wind and solar too. I would not expect that you could do a straightforward calculation like that to get to a big number and neither would I expect the Government to want to levy those kinds of costs on consumers. This is partly my point earlier about the importance of not viewing this as a static position because there are lots of reasons to think that the way the consumer pays for this will need to change as well as the quantum changing with it. I am excited to see what the Government come up with here because the consumer aspect to this has not had much attention in the last five to 10 years.

**Lord Blackwell:** You are right that whether it is through bills or through taxation, in the end the consumer ends up paying for it. Thank you very much.

Q61 **Lord Allen of Kensington:** Good morning, Chris and Mike. I am required to declare and register my interest. I am chairman of Balfour Beatty, which operates in this space and in the green space.

First, I am interested in how confident you are about the Government being able to provide a robust set of plans that builds on a rather thin 10-point plan and that there will be a real practical road map. Secondly, I am interested in your views on whether the Government will be able to meet their own targets. I was interested to see that the CCC commented in June that they were slow to follow their own targets.

The third thing I am trying to understand is which areas you see as having the highest impact on achieving net zero. Is there any way that

can be accelerated?

**Chris Stark:** Thank you, Lord Allen. Am I confident that the Government can put in place a practical road map? I am confident that they can. Whether they will is the key question, because it is important that we see it now.

If I might introduce a new angle to this discussion, we have been talking a lot about investment in capital assets and that is a very important part of the transition to getting to net zero. If you buy a fossil-fuelled asset today and start using it, it is likely you will be doing so for 15 to 20 years, so we need to think in more straightforward terms about the achievement of this target by 2050. If you think about that period of 15 to 20 years, if we want to see the low-disruption transition we talked about, where we are steadily replacing capital assets and moving from high carbon to low carbon over the course of the next 30 years, then 2030 is the date we need to be thinking about.

That is the point when we need to be ready to start phasing out the sale of those high-carbon assets. It might be earlier in some sectors and it might be later in other sectors, but at least to begin the process of actively changing over the capital stock from 2030 onwards and preferably earlier than that if we can. Thinking in those practical terms for me reveals the importance of the decade ahead; 2030 is only nine years away. This is the point when we need to see the policies. We need to understand from the Government, for example, what they plan to do about that hydrogen discussion we have just had and how we will decarbonise buildings. There are many ways to do that. What is the plan region by region across the country? Some regions will be able to specialise in certain aspects of this transition. It would be good to bring that together.

This is not about an entirely state-led plan, but it is entirely right that in the coming years we will be preparing the market for that big transition and that switchover that comes in the 2030s. We have done these switchovers before. That practical road map is about those kinds of policies and we need them to be coupled with the fiscal reforms that will make this an easier transition for the consumer as well. We have talked a lot about that today.

I am confident it can be done. I suppose there is a clue that the Government are confident that it can be done as well, because you can see that in the various strategies and policies that we have seen from them, particularly over the last 12 months. I might say some of them have been delayed and some of them have been too slow, but we are now seeing them come together and they do start to look like the kind of integrated plan that we would need.

It comes then to the second question that you asked, Lord Allen, about whether it is enough. So far, in the evidence from the Government in those various strategies—we have seen a transport plan, a plan for industry, various aspects of an energy policy, an energy strategy, the 10-

point plan, as you mentioned—we see some big steps forward on decarbonisation and a willingness to set some bold policies, but in our assessment, slightly short of the kinds of changes that we need to be making to be on track for the legal targets. I hope we will see in the forthcoming net zero strategy, accompanied by whatever we see from the Treasury, something that raises the overall ambition here and makes us all feel more confident that we will meet the imminent targets now for cutting emissions as well as the long-term targets overall. Those imminent targets—by that I mean the targets we have for 2030 and 2035—are very stretching indeed and they require that step up in preparation and investment across the economy.

The most important of those strategies and policies are certainly in those areas where we have not seen progress to date. At the top of the list for me is this heat and buildings strategy that we have not yet seen from the Government. I am probably most interested in reading that one in the next few weeks.

**Q62 Lord Burns:** Thank you very much, Chris. You paint a very enticing picture of how we use the end of life of existing capital to replace this with new low-carbon investment, by which time you have judged that some of the costs will have fallen. You have also mentioned some of the distributional consequences from different forms of investment. How can this process be managed and regulated? You say of course we need a clear government plan, but should there be a new regulatory or co-ordinating body to have oversight of all of this, to monitor it as it goes along and to point out where progress is being made and where it is not? Within all that, how do you see the role of Ofgem?

**Chris Stark:** It is a difficult one because it does not jump out immediately from the numbers and the technical analysis that we need a new regulatory outlook, but we can see some failings in the present arrangement. I am fairly sure that if people from Ofgem were here, they would agree with that. There is a need to think again about how this is regulated. Giving Ofgem a net zero responsibility seems like quite a sensible step because that gives it a different outlook. It will think more strategically about the changes that lie ahead so that we can minimise the cost to the consumer in the long run. That is important. It will clarify the need to take that long view as well, particularly about those strategic energy infrastructure upgrades that we have talked about already today.

There is a greater need generally for better co-ordination. There is a role for a better outlook and more appropriate governance around the heat decarbonisation challenge, especially in particular—and I mentioned this in my last answer—the need to be more focused on region and more focused on place. We need to respond to the specific characteristics of each region of the UK, particularly on this heat decarbonisation challenge.

To give you a sense of that, I am in Glasgow today. It makes sense for a city such as Glasgow to consider its options and it might well consider that some sort of city-wide heat network is the best outlook for a city such as this. Taking the heat from the Clyde that runs through it is

sensible to think about. If you are in a rural location, it is not an option and it would make sense to have a more reinforced electricity network so that you can have more electrical heat demand. We will see these niche things such as hydrogen.

Crucially, we will need a plan for this. We will need some sort of authority to bring those plans together; otherwise, Ofgem will struggle to sign off on the investment plans without a stronger sense of how this will fit together. We have looked at that in our analysis. We have advocated for more local area planning generally when it comes to the heat, transport and buildings transitions we have talked about today. Of course, that needs to be done consistently across the country. The technical capacity will need to be there to develop those energy plans, not to mention the very real and democratic need for public engagement about all that.

That probably does point to some new layer of governance that is missing at the moment in all this. I would not want to see local authorities simply given that responsibility; neither would I want to see the distribution network companies take it. We will need to think strategically about those changes. It is tricky for us. We dwell mostly on the technical analysis of the transition that is ahead. These are governance questions that do not jump out immediately in black and white from the spreadsheets.

**Lord Burns:** Should we be separating the regulatory side of the electricity generation from the distribution side? Once you get into the generation side, all manner of other bodies also have an interest in this to do with competition and many of the technical challenges. Then there is the question in the sense of protecting consumers and making sure that the deals they are being offered by the various things that will come forward are also fair and reasonable and that customers are being treated properly. Is it possible that one body should be doing both the generation side and the distribution side?

**Chris Stark:** It would be very difficult to have one single body doing all that. There is a lot to agree with in your question. Mike, you have thought a lot about some of these issues. Do you want to come in?

**Mike Thompson:** We have not taken a view on that issue specifically. We know we are facing an increasingly integrated market where electricity is used to power transport—cars sitting on driveways acting as batteries and putting electricity back into the grid. At the same time we have hydrogen that is potentially being made from electricity and at other times making electricity to also be used in other parts of the energy system. We are very cognisant of this need for real integration and a regulator that can think from a systems perspective. Certainly, hydrogen would have to be within Ofgem's remit as an obvious thing alongside electricity and gas, along with heat networks, as Chris has pointed to. We would want to see that integration. That does not mean it has to be all within one body and of course you can achieve that in other ways, but that is clearly very important in making the system overall fit together.

There are some practical examples to think about in terms of what Ofgem has to do. We know that the electric vehicle rollout has a chance to save an awful lot of money. It could be held up by failing to strengthen certain lines and provide enough transmission and distribution capacity. If that slows down the whole programme, it will add a lot more costs in delaying the programme than it would in making those investments first. Similarly, strengthening cables to service a household that has electric cars is different from strengthening one that has electric cars and heat pumps. A danger is that we end up digging up roads multiple times, which we know is expensive.

Again, it points towards oversizing and choices up front that are about keeping those options open and about minimising future costs. There is a danger that Ofgem historically has been very focused on keeping costs down. It will have to think increasingly—as it is supposed to and as it does—about the future costs as well. The range there is much higher. There is also a need for a different attitude that says we will oversize and we will sign off anticipatory investment where there is a clear potential for it to make costs lower in the future.

**Lord Burns:** But most of those things I would classify on the distribution side of things. I interpret your story, apart from the hydrogen, as a big bet upon electricity and therefore having the capacity for the generation of low-carbon electricity and then what happens to the price. But then there are all the consequences of turning that electricity into all the goods and services that people use and doing it in a way that customers will be able to manage.

**Mike Thompson:** Yes, we agree.

**Chris Stark:** Yes, that is a very fair summary.

Q63 **Lord Grade of Yarmouth:** The whole plan depends on clear government policy and it relies on huge investment from the private sector. If I were looking to invest as a private sector operator in the future, I would have at the top of my risk assessment the concern about a change of government and a change of policy. To what extent does any plan rely on political consensus right from the outset?

**Chris Stark:** That is a difficult question to answer. You are right, of course, that a change in policy and with it potentially a change in government is indeed a risk. We have seen that along the way. Interestingly, the whole time we have had the Climate Change Act, we have not had much by way of government change, so investors are comfortable that the policy mechanisms that we have in place at the moment at least are the kinds of things that will stand the test of time.

I would point to the underlying economics of this, Lord Grade. Yes, there may well be policy changes and changes of government. I would expect that of course over the next 30 years, but the underlying facts will not change. The need to invest in things that will decarbonise the economy will remain, regardless of the policy instruments that are chosen.

I suppose that points to, as far as it is possible, the present Government taking the long view on this and trying to design policy instruments that are likely to remain in place for a long time and regulatory instruments, such as the contract for difference in the energy sector, and a consistent approach to carbon trading. Those kinds of things tend to last the change of government and tend to withstand the short-term focus that politics brings.

You are absolutely right to raise this. I will go back to something I said earlier. The overall cost of this will be impacted by the cost of finance. If we see lots of flip-flopping in policy and if we see lots of risk in policy, then we will expect financiers to extract a higher price for that and that is an unnecessary cost. It may be difficult to say it, but it is our role to point this out. The long-term view is the right one. To put in place stable policies that are likely to withstand changes of government is a responsibility of the present Government when they are coming up with this net zero strategy overall.

**Lord Eatwell:** Following on from that, you may change policy because you find in 10 years' time you have made the wrong bet, so that is one of the issues one has to consider. In that context, I was very struck when you said, Chris, we have done these switches before. Could you tell us about one or two of those switches and what went wrong with them?

**Chris Stark:** Let me explore that a little, Lord Eatwell. In general, this country is good at these switchovers. One I might pick out is the digital television switchover, which was managed in a way that we could manage the hydrogen switchover I talked about earlier, where you prepare with new devices in the home, some of which will never use digital signals, but you are ready at least for a certain proportion of the population to then switch over when the moment comes. The lesson of that is that you go early with something that mandates a change in the standard—a change in the standard of the television you are buying, in this case—and when you have a sufficient population of those televisions, you then go to the harder bit of the population, those who have not made that investment or who are not able to. That points to the kind of change that we might make with some of these technologies that we see for heat, for example. There might be a similar change there. That is one example. That is a good example.

We have another example from the broadcasting space, which we probably went to earlier, and that is digital radio. You find that there is a better standard in Europe. Again, I do not want to dismiss the challenge here. Going early on this is tricky if you pick the wrong standard. When it comes to the heat technologies, which of course are often at the heart at the political discussion on this transition, they are well established in other parts of the world, so we can be confident that we can make this transition. Hydrogen is different because we need to establish that it can be done. You do not find that in any other part of the world, although places such as Holland are thinking about it. There is an interesting set of experiences from broadcasting that we could draw on perhaps.

The other transition I will pull out is our transition from coal to town gas and from town gas to natural gas. The natural gas transition over the 1970s was one that we made very successfully. We made it a national mission. We were clear on what needed to be done in every part of the country. There was a certain amount of national pride in that transition as well. There is quite a lot to learn from that and indeed the extent to which the Government took ownership of that and made those plans. Again, a lot of that would help in the transition that lies ahead, not just in heat but in transport and in various aspects of this net zero transition that we see before us. The idea of an infrastructure switchover plan would help.

**Lord Eatwell:** The other big transition that might give us some lessons is of course the West German recapitalisation of East Germany, which was associated with the solidarity levy to pay for it.

**Chris Stark:** That is fascinating, Lord Eatwell. I would be very happy to look into that after this. Again, I would love to see more thought given to these big underpinning policies and shifts that would help with this transition and make us all feel more confident about how it will be achieved.

**The Chair:** Thank you very much. That is in some ways the task we have set ourselves and it has been very helpful today to hear from you. Could I ask for one piece of homework? Cutting across all the discussions has been the need for government policy and clarification and in some cases very soon in order to meet the sort of timetable that is implicit in your report. I wonder whether you could give us your view of the policy priorities that need to be settled over the next six months or so. We are expecting to hear from the Treasury. One gets the impression there are discussions around a number of other issues that are germane to hitting the net zero target. What would you regard as the key issues that the Government need to have on their policy agenda and the clarity that is needed on those issues in order to meet the timetable that is implicit in your budget? That would be very helpful for us.

**Chris Stark:** I am very happy to take that away as a piece of homework and we would draw on the recent report to Parliament that we published in June. We have set out some of those in outline, the policies that we would need to see filled in. I can undertake to write you, Lord Hollick, and we can bring that to your attention.

**The Chair:** That would be helpful. Chris and Mike, thank you very much for your contributions today. That brings this panel to an end. We will have a short intermission and we shall resume with the second panel.