OFFICIAL REPORT
AITHISG OIFIGEIL

Economy and Fair Work Committee

Wednesday 7 January 2026

Session 6

The Scottish Parliament
Pàrlamaid na h-Alba

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ECONOMY AND FAIR WORK COMMITTEE
1st Meeting 2026, Session 6

CONVENER

*Daniel Johnson (Edinburgh Southern) (Lab)

DEPUTY CONVENER

*Michelle Thomson (Falkirk East) (SNP)

COMMITTEE MEMBERS

*Sarah Boyack (Lothian) (Lab)
*Willie Coffey (Kilmarnock and Irvine Valley) (SNP)
*Murdo Fraser (Mid Scotland and Fife) (Con)
*Stephen Kerr (Central Scotland) (Con)
*Gordon MacDonald (Edinburgh Pentlands) (SNP)
*Lorna Slater (Lothian) (Green)
*Kevin Stewart (Aberdeen Central) (SNP)

*attended

THE FOLLOWING ALSO PARTICIPATED:

Professor Paul de Leeuw (Robert Gordon University Energy Transition Institute)
Stacey Dingwall (Federation of Small Businesses)
David Thomson (Food and Drink Federation Scotland)
Professor Karen Turner (University of Strathclyde)
Richard Woolley (Chemical Industries Association)

CLERK TO THE COMMITTEE

Anne Peat

LOCATION

The Robert Burns Room (CR1)

Scottish Parliament

Economy and Fair Work Committee

Wednesday 7 January 2026

[The Convener opened the meeting at 09:30]

Draft Climate Change Plan

The Convener (Daniel Johnson): Good morning, and welcome to the first meeting in 2026 of the Economy and Fair Work Committee. I wish everyone a happy new year. I believe that we are still in time to be doing such things.

This morning we start our evidence sessions on the draft climate change plan that the Scottish Government has published. Before we begin, I note that Kevin Stewart and Michelle Thomson from the committee are joining us online; Richard Woolley, who is one of our witnesses, is also appearing remotely.

We are joined by a panel of witnesses comprising: Professor Paul de Leeuw, director, Robert Gordon University Energy Transition Institute; Stacey Dingwall, head of policy and external affairs for Scotland, Federation of Small Businesses; David Thomson, chief executive, Food and Drink Federation Scotland; Professor Karen Turner, director, centre for energy policy, University of Strathclyde; and Richard Woolley, head of energy and climate change, Chemical Industries Association. I should note that Professor Turner is also joining us online.

Given the number of witnesses, I ask that in the first instance members direct questions to a particular member of the panel, but if other witnesses want to come in they should please try to catch our eye or indicate online.

I will open the questioning. When I think about the debate surrounding the previous climate change plan, I recall that there was considerable criticism that it was heavy on high-level targets and light on detailed implementation. That risked there being a lack of clarity on how things were meant to proceed. If we look at the figures on carbon reduction categorised by industry, we can see that there has been a 57 per cent reduction since 1990. However, that has been driven not by carbon initiatives but by deindustrialisation. Does the current draft plan represent a step forward in providing such detail, or are we risking further deindustrialisation in Scotland?

Given his broad expertise, I will bring in Professor Paul de Leeuw to open up the responses and to provide his observations.

Professor Paul de Leeuw (Robert Gordon University Energy Transition Institute): I will be delighted to do so. Thank you very much for the opportunity to be here.

First, I welcome the enormous amount of work that has been done by whoever pulled the draft plan together. There is some very good-quality material in its many pages, and I am impressed by what has been done.

I will make three observations to get us started. The first is that when I initially read the document—and I reread the summary version a couple of times—I noted that it said it was a climate change plan. However, the more I read it, the more that I thought it seemed like an emissions reduction framework. A lot of elements were just not covered in it, particularly on resilience adaptation and various other aspects. Therefore, the first issue that struck me is that we need to pick the right language. We all want to get to net zero, but it is a matter of seeing how we can get there.

The second point that I picked up on is that there is a lot of detail in the draft plan, but to my mind it is not clear about who would pay for what, who would get what benefit, who would do what, and how it would all play out. Especially if we are looking at this through the lens of business and industry, it is important to be clear about what we are asking companies, organisations and others to do. Having a plan is one thing; delivering it is another.

I will keep this simple for now, convener, if that is all right, but I will be very happy to zoom in on the detail later. My third observation is that we need to understand the cumulative impact of all that on businesses, industry and consumers. An awful lot will happen, and there is an awful lot still to be done. However, it is not clear to me how that will show up for someone in business who is sitting out there.

Before I went to university land, I had spent all my life in industry. It is hard to say how this will play out. You can do all the stuff, but you cannot do it all at the same time. It is about how we prioritise, how we make things happen and how we can support steps through multiyear funding. I know that budget conversations will happen, but such conversations in the Parliament tend to be about one-year periods. This will involve a multiyear funding plan that will need to be put on the deep end and prioritised.

Those are three points to get us started. I welcome the enormous amount of work that has been done, and the power that sits behind the draft plan, but there are fundamental questions about how it will show up for business and industry and about its cumulative impacts.

The Convener: Thank you for that. What the plan will look like for business and industry is the very specific lens through which we hope to look at it. I know that colleagues will wish to follow up on the investment and financing aspects.

I will bring in Professor Karen Turner on the same point. Have we drilled down in sufficient detail? Is this actually a plan, or is it still a set of ambitions on emissions reduction?

Professor Karen Turner (University of Strathclyde): I agree with Paul de Leeuw that what we have here is probably moving towards a plan. However, I share his concern about how the costs will land. Determining who will pay involves asking not just those direct questions about financing and the general approach. Obviously, things will knock on. A lot of analysis shows that households ultimately pay through either taxes or the prices of goods and services. In operating such a plan at the Scottish level, especially in the context of aspects such as the competitiveness of firms in Scotland, the real challenge would be whether we would end up paying through jobs if such competitiveness were lost and if emissions activities as well as jobs were offshored.

One of my concerns from reading the plan is about the up-front costs. It feels as though those are glided over a little. On much of the financing there are issues involving devolved versus reserved matters, which we still need to bottom out.

There are also timing issues. There is a lot of concern about the oil and gas industry running down. A wider concern is whether we will be able to soak up a lot of those jobs when we transfer workforces across.

If we are trying to do a lot, we might have some congestion in the near term, which could push up the cost of the transition. It is not just a question of arriving at an absolute amount in pounds for what has to be done. We must consider how we will pay for things and also the wider economic reaction. That could cost jobs and affect what we might call the overall bill in pounds. There are questions about the how, which is what we need to get to through the plan.

The Convener: In what has been published, is there sufficient additional clarity on the how?

Professor Turner: Not yet—no.

The Convener: I move to our witnesses from industry. I will ask a couple of more detailed questions about the role that hydrocarbons play in our industrial processes.

When I have done visits to industry, it has always struck me how reliant we are on gas for heating things—whether it be kilns for making cement or concrete; or, if I can pluck out the example of our whisky industry, for making glass bottles or heating stills. Yet, although electrification is mentioned in the document that is before us, in the annex—which is where the detail is meant to be—there are only two paragraphs on that subject, which take up less than a third of a page.

Is there sufficient focus here on how we can replace gas as a heat source for a broad range of uses, from concrete or steel to whisky? Given that whisky is Scotland's biggest non-energy export, I will put that question to David Thomson first.

David Thomson (Food and Drink Federation Scotland): It is not just in the whisky sector that that happens. Across the whole of the food sector there is significant use of gas to heat, to bake, to distil and to brew. In the manufacturing part of the food and drink industry, the energy transition and the decarbonisation of heat are the biggest factors for individual manufacturers on their own sites.

At the moment, the cost of electricity is a major disincentive. From the perspective of our firms, to change from gas to electricity now is not financially viable because of the high cost of electricity. That is a significant issue. The industry knows that decarbonisation of heat—whatever the solution for heat might be, whether it is electrification or hydrogen—is the next step, but those are big, long-term investments for businesses regardless of whether they are small, medium or large. At the moment, the electricity cost is such that it provides a major disincentive for companies to move forward.

The Convener: I do not know who might be best placed to answer this. The cost is one element, but there is also a ceiling on the temperature to which electrical sources can heat things. That might suffice for some processes such as distillation, but it certainly would not for others such as cement or concrete manufacture or for other very high-heat applications.

We might not have an industry-specific representative on the panel, but does any of our witnesses have any insight on that? Do we need more focused research and development on how we can replace gas as a high-heat energy source?

Professor de Leeuw: I am happy to come in on that, because energy is my space. For certain processes you need very high temperatures. For example, in steel there are particular treatments for which arc furnaces and the like are used. If we want to decarbonise, for the vast majority of industries low-cost electricity will be the big lever. As David Thomson correctly pointed out, the moment that the Government makes low-cost electricity available, market forces will drive forward most of the other elements. Therefore, if you wanted to simplify the plan, you could say that having access to low-cost electricity would go a

long way towards sorting out the industry and business processes.

That idea is not unique in the world. Other countries have been quite successful in driving low-cost electricity, and their economies have benefited from it. There would be a huge opportunity—a huge prize—here for Scotland if it could drive down the cost of electricity, which would help small businesses, the food and drink industry and others.

There will be elements where we cannot do that, and those industries might need to look at alternative options. Those could include a combination of hydrogen and other elements for which we would need to put some mechanism in place if we were to make it successful.

The Convener: Lorna Slater wants to ask a supplementary.

Lorna Slater (Lothian) (Green): You have raised a very good point about the importance of driving down electricity costs. Do you have a shortlist of the actions that the Government needs to take to do that? I assume that one of the actions would be undoing the artificial link between electricity costs and gas costs that we have in the United Kingdom. What else do we need to do? I agree that electricity costs are a key driver.

David Thomson: Yes, decoupling is one of the ways to do that. If that is not possible—and we understand the policy reasons for that being in place—the kind of thing that you could do is provide incentivisation for decarbonisation projects, maybe over a 10-year term to deal with the increased costs; providing some kind of support in that way would moderate the costs for a business over a longer period.

Lorna Slater: Do you mean a specific subsidy as opposed to policy change?

David Thomson: Yes, if policy change is not possible.

Lorna Slater: The only policy that you have identified is the decoupling. Are there no others that you would consider?

David Thomson: That is the biggest element.

Professor de Leeuw: I do not know whether you have had the opportunity to look at your own domestic gas and electricity bills. They are quite interesting to look at—although every bill is slightly different—because the cost is about 6 or 7p a kilowatt hour for gas and about 26 or 27p a kilowatt hour for electricity. We have a huge issue. It is four-and-a-half times more expensive to use electricity than to use gas. That is quite an interesting element. If gas is the issue, why are electricity prices so high? Gas is a lot cheaper. There is a lot loaded in through compliance and distribution costs and green charge elements.

There is an element around redistributing and thinking about how we reduce charges, but we have a capacity that is currently locked in, particularly because we cannot use our wind turbines all the time. We have constraints in the system that mean that we pay money to actually not produce electricity. Finding a mechanism for unlocking the capacity that is already built and sitting there so that we do not pay out in unnecessary charges will go a long way. Far better distribution, far more strategic investment in the infrastructure and far smarter consenting—a lot can be done in the planning window set out in the climate change plan.

The Convener: Stephen Kerr would also like to ask a supplementary.

Stephen Kerr (Central Scotland) (Con): Professor de Leeuw, you said that other countries have done low-cost electricity and you mentioned a couple of mechanisms in your previous answer. Can you describe what those countries have done to get to low-cost electricity quickly?

09:45

Professor de Leeuw: I will keep it short because I am conscious that there is a lot to go through. Some really interesting examples include what France and Norway have done. We have a system in the UK where gas is the marginal cost of electricity. The way the system works is that, once the mechanism comes on, we are using gas generation, which sets the electricity price for everything else. That is not the system in France. In France, nuclear is the back-up price and because it comes in at a far lower cost, the electricity price is a lot lower. That is why we import elements. In Norway, it is hydro, and there are different elements in there. Of course the market will determine the prices, but there are other ways of doing it, because we have the marginal cost linkages to gas. That is what has set the price in recent years, so decoupling that will be critical. That is within the power of Government. It will require a reset of the system, which is not a straightforward thing to do.

The Convener: It is interesting that France has the lowest electricity costs in Europe, as I understand it. I believe that Karen Turner would like to come in, and then I will go to Richard Woolley with some specific questions.

Professor Turner: I will add one point to what Professor de Leeuw said about our capacity. It is not just about firms using electricity in terms of things like green hydrogen production. We are doing work up in Shetland on the Sullom Voe terminal that is looking at low-carbon fuel

production and whether there could be a connection to the offshore wind farms in the NE1 site. One of the challenges is regulation—Professor de Leeuw referred to a reset of the system—in relation to whether you can have what might be referred to as a private line and use excess capacity in other ways. It is not just about firms using electricity for their heat; it is about using things like the production of low-carbon fuels and green hydrogen derivatives as a way to access electricity. Obviously we are talking about the cost of what we take off the network with the high price of electricity at the moment, but it is also about the cost of producing and getting to different production sites.

It is a wider question than just the use of electricity and lowering the market price of electricity. It is also about how we can use some of the excess capacity, avoiding procurement costs, but also providing access to low-carbon production processes.

The Convener: Richard Woolley, I know that you want to come in on that, but I want to ask you something specific. As well as industrial heat, the other area that is of particular interest is the use of hydrocarbons as a primary product for industrial production, whether that is in pharmaceuticals or the chemicals industry more broadly, with dyes and plastics that are absolutely key to the economy. The replacement of hydrocarbons in those processes is very much reliant on recycling. What are your thoughts and views about how clear this plan is on replacing hydrocarbons in our wider supply chains?

Richard Woolley (Chemical Industries Association): Thanks very much for the opportunity to be here and talk to this point. Hydrocarbons have been the backbone of UK industry for a long time now. The reason why the industrial clusters are where they are is that, historically, they have been where the oil and gas would come onshore—the chemical industry would then turn that into the basic raw materials that go into our manufacturing industries in general. The chemical industry sits at the heart of our manufacturing supply chains and it is critical to a modern manufacturing economy. Thanks very much for bringing that to the attention of the committee.

On the on-going importance of carbon, we need to get to a world that is net zero, and that requires the eventual circulation of the carbon that we have already extracted throughout the economy. We have carbon in an economic pool, an atmospheric pool and a biological pool. We need to be pulling on all of those resources to start to displace the carbon that we have historically been pulling from fossil fuel resources. It will not happen straight away, and in fact we are quite a long way from that position. That is because if we are pulling carbon to use in products from sources other than fossil fuels, we are having to do all the work that geology has done to get to a raw material that is usable to create the kind of advanced materials, pharmaceuticals and chemicals that we use every day in our modern lives. That is obviously a very energy-intensive process. Planet Earth took millions of years of high pressure and high heat to get to the incredible material—crude oil—that we have been using. We will have to do the same thing. We will have to reach high temperatures and high pressures. That is energy intensive, and we will have to do it with electricity.

The industry is looking at three main sources for carbon in the future. There is bio-based carbon. Any waste biomaterial from forestry and farming—anything that cannot otherwise be used—we can turn into valuable product, adding value to the economy. Another source is recycling, as you correctly mentioned. Even the stuff that cannot be mechanically recycled can be captured by our industry and chemically recycled into Tacoil, which is similar to crude oil, that can be used again for things like chemical production or even sustainable aviation fuel production.

The third source is captured carbon. One of the side benefits of putting carbon capture infrastructure in the clusters—we are waiting for funding to come to the Scottish cluster and we hope that that will happen soon—alongside hydrogen infrastructure is that we can take the captured carbon molecules and combine them with hydrogen to make hydrocarbon molecules that can be used for the chemical products that we currently make with fossil fuels.

All of this stuff is energy intensive and we are already in a position where the industry is uncompetitive because there are other locations with cheaper energy costs and cheaper raw material costs. We are already uncompetitive, and to make the transition we are facing increased energy use, which at the moment would make us fall flat on our faces. Without action to drive down the electricity price and, in the short to medium term, drive down the gas price, the industry remains at risk. It is critical that we get the energy price situation right. We were pleased to see mention of that in the industrial strategy and the Scottish climate change plan. We note your point that there is a very small section on reducing the electricity price, but I think you make it clear that a lot of this is reliant on national policy action, which is key. Your pressure on Westminster in that area is really useful and we thank you for that.

I will pick up the electricity points. You mentioned that high-heat processes often do not have off-the-shelf technology that can be deployed using electricity. That is the case in our sector for

high-heat processes like cracking. There is ethylene production in Grangemouth that relies on high-heat cracking. There is not an off-the-shelf technology, as there is in the steel sector with electric arc furnaces, for the cracking of ethane into ethylene. There are various conglomerations of chemical companies working towards that, but they are still pilot scale. There is nothing that you can buy that you can plug in and play. If you could buy it, plug it in and play it, you would not do it here because the electricity price is too high. In the interim, it is fundamental that the Acorn cluster gets the funding to deploy the hydrogen network so that we can start putting hydrogen into the high-heat processes in Grangemouth and start building out some of the projects that were identified in project willow.

On the electricity price in general, it is not just about the electricity price versus the gas price here. Global firms are looking around the world for where they invest. We can have the cleanest electricity here, but if it is not competitively priced they will invest in electricity-based chemical production elsewhere. They are looking for competitively priced electricity to underpin the manufacturing. You have to look at the price versus gas in the UK, but also versus electricity elsewhere.

What is keeping the cost high? It is everything that everyone has already said, but it is also the policy cost. No one has mentioned that yet. We have subsidies for the deployment of renewables in the UK that are currently paid for on the electricity bill. There is support for some, and there is more support coming for some, to remove that policy cost from the electricity bill, but more is needed—that support is needed for more firms. There is also—

The Convener: Apologies, Mr Woolley. We have a lot of questions to get through and I am sure that you will have other opportunities to speak.

Before I move on to Michelle Thomson, I want to bring in Stacey Dingwall. Coming back to my original question, the vast bulk of private businesses in Scotland are small businesses, and a lot of them struggle to understand what they are supposed to do, what the plan is and what support is there. Does the draft climate change plan move us forward in providing clarity for small businesses, or is there still work to be done on that?

Stacey Dingwall (Federation of Small Businesses): You have captured it pretty well. None of our members has spoken to me about the draft climate change plan. You often hear people say, “Have you responded to this consultation? Are you on this?” No one has mentioned the draft climate change plan.

The plan is far removed from the everyday life of most small businesses. FSB represents all small businesses across Scotland. We have members that are very involved at the cutting edge and delivering some of this, but the vast majority of them are not. We surveyed last year and asked our members to describe their understanding of Government net zero targets. Fewer than 25 per cent said that they had clear understanding, two thirds said that they had absolutely no understanding and getting on for 90 per cent said that they had never engaged with any of the Government initiatives on net zero.

The plan falls into the trap of talking about “business” and assumes that business is all one thing. We can break business down into different sectors and different geographies, but we need to break it down by size of business as well. When most small businesses think about net zero and climate change, they assume that there will be a burden on them that will inflict more costs, whereas we know there are a lot of opportunities in there.

There are good things in the plan. It talks about apprenticeships and support for employers, but there is probably too much narrative and it is too descriptive. There is not the concrete information that a small business owner needs for planning for their business or thinking about how they might pivot their operations. It has not moved us on enough to give them the confidence to feel more engaged and make more plans relating to Government policy.

The Convener: Thanks very much. I apologise to members for spending longer on my questions than I intended. I bring in the deputy convener, Michelle Thomson.

Michelle Thomson (Falkirk East) (SNP): Good morning. I am sorry I cannot be with you all in person.

I want to return to something that Professor de Leeuw alluded to. Rather than talk about the small and medium-sized enterprises—I recognise the comments that have been made by the FSB—I want to draw your attention to the Scottish Fiscal Commission’s “Fiscal Sustainability Perspectives: Climate Change” report of March 2024, which I do not hear talked about often enough. Fundamentally, it made it clear that the need for additional spending in Scotland is estimated to be 26 per cent higher per person than in the rest of the UK. It also made it clear that under the existing fiscal framework, the transfer from the UK Government to the Scottish Government is not set up—particularly in relation to the use of capital—to allow for the persistency that is needed year on year. I put on the record that SFC estimates that an additional £700 million is needed every year. That is in the context of the current Scottish

Government budget of £450 million a year, with a further £21 billion in mitigation required over the next 25 years.

We could have a discussion about who spends that money, how it is spent, the role of business and so on, but I want to explore with panel members the extent to which you are aware of that report and those compelling figures, and I would like your thoughts on what a critical oversight it would be not to reflect on the money requirements of any plan coming forward. Perhaps one of the professors would like to come in first on that.

Professor de Leeuw: I am not familiar with the Scottish Fiscal Commission's report, so I cannot comment on that, but the point that you raise about the funding required is very real. We have some learnings from the past. We here are all consumers. If you look at the implementation of things such as smart meters in our homes, fibre broadband and, down south, water meters, you see it is very hard to do.

10:00

There is an element of needing to do something with business and something with consumers. It is very hard to make these changes happen. As I said in my opening remarks, we absolutely need to prioritise at a big scale. We should not try to do everything all at the same time, but try to do a number of things that have a material impact. If you look at the areas identified in the climate change plan, you will see that three areas represent 60 or 70 per cent of the emission reductions. I would say that we should focus the five-year windows on those elements, which will make the biggest and fastest difference. We should not try to do everything all at the same time, because money is not available. It would be spread too thinly.

There is an opportunity to tweak the plan a bit and still get to the same outcome. The destination does not change—it is the journey of how you get there. All the comments from the panel, my own experience and the Fiscal Commission comments that Michelle Thomson mentioned all point in the same direction: the need to have a sensible plan.

When I read the plan, I had what I call—forgive me for using this language—a little Ikea moment. I know what the starting point is, which is a flat pack, and I know what the end point looks like, which is net zero, but what I am missing is the instructions and the plan in the middle. If we want to have something credible, we need to make sure we manage this and have that credible plan in the middle.

I quite like that the UK Government has mission control. What Scotland needs is emission control: somebody who looks at nothing else but emissions annually, for five years, to drive them down. However, I would prioritise spending the money wisely. We just do not have enough money to do all of this. This is a hugely expensive thing to do and we need to make sure that it is acceptable to the business industry and, most importantly, the consumer. Somebody will have to pay for it, and money is very tight.

I would say that your steer and your guidance are right, but those need to be turned into an actionable plan with visibility and measurable outcomes.

Michelle Thomson: I can see that Professor Turner wants to come in, but before I bring her in, can I just gently challenge you? I totally agree. Clearly a prioritisation process needs to take place. That is how you make progress on any substantive project, and you do not get more substantive than this. However, the point that I am making is that under the fiscal framework, the fiscal transfers to the Scottish Government are so limited. As things stand, the estimated figures to allow the crowding in of private capital have not been baked in. That is just not being considered as part of the fiscal framework, and that seems to be a fundamental impediment to the prioritisation process that you are setting out. Surely that must be a concern.

Professor de Leeuw: Yes, absolutely. Connecting the dots between the outcome, the plan, the investment and the activity is absolutely right. Again, a plan without money is not a plan—that is hope. What you are saying—that we need to connect the dots—is very important. It is a credible plan, but it cannot be an annual plan. We are talking about multiyear funding and this is about the next 20 to 25 years. Sufficient funding is key and prioritisation is key. We are finally agreeing, but we might just use slightly different words to get there.

Michelle Thomson: Professor Turner, I know that you want to come in.

Professor Turner: I think the same. I did not read that particular document ahead of coming to this meeting, deputy convener, but there is a very important point here around capital spending and the way that the Scottish budget is configured. One of the major issues has been annual funding. There have been a lot of limitations in how the Scottish Government has been able to intervene because it is working with an annual budget. It is not just about the absolute amounts; it is about when you are able to spend and what you are able to plan for.

To have a proper climate change plan, there needs to be not just the money behind it, but the actual process by which things will happen. We are in a situation where control over the up-front

costs—the capital costs and things like that—is reserved, so it comes down to co-ordination between the Scottish and UK Governments. It has always been peculiar that the Scottish Parliament has devolved responsibility for reducing emissions but does not have all the necessary levers and actions. That is an important point. Annual budgets and annual spending mean that the Scottish Government cannot make commitments against which commercial actors, from small businesses to larger businesses, can make some of these investment decisions.

Michelle Thomson: You both make a compelling point about the need to take a multiyear view, which does not happen at all. The reason that I am raising this is that the Scottish and UK Governments are talking about revisiting the fiscal framework. The Finance and Public Administration Committee, of which I am also a member, has made some compelling suggestions about the need for multiyear funding.

I want to give other panel members the opportunity to give further reflections. Richard Woolley, do you have a view on the points that I have made about capital? I cannot see anybody else on the panel just now because I am online.

David Thomson: Thanks. It is David Thomson here, and I will give a smaller perspective than the one that we have been talking about. I was not aware of the Scottish Fiscal Commission's report, but it is clear from individual business costs that the cost of all this will be very expensive over the next few years. A large biscuit bakery could see costs in the range of £10 million to £35 million for full decarbonisation, depending on the site size and complexity. If we multiply those figures, we get to quite a lot of money.

One of the things that we would highlight in response to the climate change plan is the importance of industry that is already embedded in Scotland, such as the food and drink industry. Thirty per cent of Scotland's manufacturing turnover comes from the food and drink industry. The issue is the transition—the change and adaptation that Professor de Leeuw has already mentioned. There is not necessarily enough in the plan about adaptation and the changes that will be required.

We are lucky enough in FDF to host the Scotland Food and Drink partnership's net zero programme, which gets support from the Scottish Government. To go into that programme at a micro level, we do not know whether we have funding beyond 31 March because of the annualised nature of this work. Of course, that is a 10 to 15-year programme to support baselining and a transition plan for the industry, working across all the partners of Scotland Food and Drink, which is the whole of the food and drink industry in Scotland. We need those long-term levers.

The Scottish Government has introduced the Scottish industrial energy transformation fund to support larger businesses in their decarbonisation journey, but we do not know whether there is any more money coming into that. There are ideas for the next stage of that fund. We would like to see it come down to smaller businesses, if at all possible.

Businesses need to understand what support may be available but, without long-term funding and support, it is very difficult for businesses to be able to plan. We get situations such as the one that we had this year, where the SIETF was reopened with a two-week window for people to get their bids in, and that kind of thing does not allow for proper business planning over the long term. As we have already discussed, and as I have said, these are long-term investments for businesses.

Michelle Thomson: That is very compelling. I do not know whether anybody else on the panel wants to come in, but, if not, I will leave it there, convener.

The Convener: Thank you. I will bring in Lorna Slater.

Lorna Slater: With the convener's indulgence, I will ask a supplementary to Michelle Thomson's question before I move on to other questions. It is about net costs versus gross costs of the investment that is required for decarbonisation. I think that we all agree that investment is required, but this is a long-term project, as David Thomson has mentioned, and, during that time, factories will have equipment that comes to its end of life, as well as normal maintenance and repair. We are definitely talking about large sums of money, and there will be some natural attrition of equipment that needs replacing, which would be part of any normal business planning, and of course there will be some amount—a fraction—of savings from insulation and efficiencies as we go forward. When sums are being quoted, are they net or gross?

David Thomson: If you are asking me directly about that, I do not know whether that is a net or a gross cost. It has been quoted to us by a member. You are absolutely right to say that there will be natural wastage of equipment, along with energy efficiency measures, circular economy measures, waste reduction measures, the use of on-site renewables and a whole range of different things on sites. That is all part of the investment decisions that businesses make.

We have already heard significant evidence about the cost of electricity, which is what stops people making those decisions, delays decisions and, if things really need to be replaced, does not

necessarily result in people making the best decisions for net zero over the longer term.

Lorna Slater: That is really helpful. One of my frustrations with the plan—it sounds as though Professor de Leeuw and Ms Dingwall have a similar frustration—is that it is not specific about businesses. We know who the big polluters are in Scotland. You can google to find a very quick list, which includes the Peterhead gas power station, the Ineos Grangemouth complex—that will have changed since the list was compiled—Mossmorran, the Shell St Fergus gas plant, the Tarmac cement works and a whole host of biomass and waste incinerators, whisky distilleries and glass plants. That is before you get to a typical small business. I would assert that we know where the big polluters are, which are not the average everyday small businesses—it is those big guys.

Any climate change plan that does not sit down with the big businesses and ask, "What is your plan for decarbonising?" is not worth the paper that it is written on. They are the ones that are creating the pollution and they are the ones that will have to fix it. To some extent, there is frustration that those businesses have very broad shoulders and do not need Government handouts. What are your views on how we tackle the big polluters and how we prioritise them and lean on them to come up with a plan for how they will reduce their emissions, instead of making small businesses feel like they ought to be doing something when they are not really the problem?

Professor de Leeuw: There is a lot to unpack in your question. Let me make a couple of observations. There are certain things that happen naturally that do not need any Government intervention. The oil and gas industry will decline; that is the nature of the beast. We already heard the announcement about Mossmorran, and we see the reshaping of the Grangemouth cluster—no doubt Richard Woolley can add more on that. That is already happening without Government intervention.

Collectively, we must be mindful about the language that we use. We talk about using fossil fuels, but fossil fuels are not the enemy; it is the emissions from fossil fuels that are the issue. We can decarbonise fossil fuels with carbon capture and storage and other elements and we can still use the energy content, as long as we do not have the emissions to go with it. The enemy is the emissions and not the fossil fuels themselves. We need to have an ecosystem that is designed in that way. We can make quite an impact if we have a cluster where we can inject carbon capture and storage and do it at scale; we can decarbonise big industrial clusters.

If you look at the International Energy Agency, you will see that there is no way that we can get to net zero—globally or in the UK—without carbon capture and storage. We have to do certain things as part of the mix. It is not just about telling companies, "You need to do certain things"; collectively, you need to ensure that infrastructure is put in place. There is an element of being able to make a bigger impact if you start with certain organisations—that goes back to my prioritisation list—but we need to make the tools and infrastructure available for those companies to be successful.

Again, I use Acorn as an example. We have been talking about it as a potential cluster for a long time, but, if we want to be serious and really play this game, we need to ensure that we have all the tools in the toolbox, including CCS, so that we do not just electrify things over time but, in the interim, take the emissions out and store them. We can do lots of different things, using all the opportunities that we have, to make it happen, and that would make a huge difference. There are six big industrial clusters in the UK but only one in Scotland. We have to decarbonise the clusters if we want to get anywhere near the plan. That will be in the detail of the implementation plan with things such as an emissions control equivalent or whatever is put in place in Scotland. That is what will really make the difference.

Lorna Slater: Does anyone else want to come in on my question?

The Convener: I think that Richard Woolley was hoping to come in.

Lorna Slater: Brilliant. Go ahead, Richard.

10:15

Richard Woolley: I want to pick up on your previous question, which was originally why I put the R in the chat. The chap from the FDF mentioned investment cycles and whether they align with technological possibility. It is not just electricity price that is a barrier; it is connection—whether a site is able to connect heat demand to the electricity grid. All the sites in our industry have a much larger heat demand than electricity demand. That is the rule of thumb. If you want to electrify that heat, you would be asking for a much bigger connection to the electricity grid, which often requires investment in the grid in terms of reinforcement and new infrastructure. Those connections are not always available at the time at which, from a policy perspective, it might be the best time to invest in fuel switching to electricity.

On the question that you just asked, there is the concept of public goods: those businesses would not be there in the first place if the UK Government had not built roads, educated local

people or built electricity and gas infrastructure. This is an extension of that. You are looking at the new industries and the new modern infrastructure, with the modern infrastructure being carbon capture equipment, which helps us to recycle carbon in the economy and to displace new extraction, and hydrogen infrastructure. Hydrogen can be used as a feedstock and a new energy source, and it can go into new fuels, too: e-fuels and sustainable aviation fuel. If the UK Government invests in those modern pieces of infrastructure, the expectation is that there will be foreign direct investment in the UK, because people will see it as a place where there is competitively priced access to clean energy infrastructure. That is our target: to be a place in which people want to invest because clean energy and emissions infrastructure are available.

We must also recognise that businesses invest where they can make money. At the moment, the businesses that are being asked to transition are just hanging on. Nationally, the site closures in our industry were, basically, one a month in the past year. Those were big sites producing chemicals, and, in most cases, they were the last site producing that chemical in the UK. We are now reliant on imports from the US, China, the middle east and Russia. It is unclear whether that investment will ever come back unless we can make the UK a place that is investable for manufacturing.

It is not just our industry in which that is happening, but we are the canary in the coal mine because we are so energy intensive. It happened first with steel; they are above us and fell over first and, basically, the Government has had to pay for the industry to change because there is no business case to make steel here. It is the same with us: we lost all our ammonia plants so, now, to grow our food, we import our fertiliser from global markets. That means places where gas is cheap—the US, Russia and the middle east. It will be the next most energy-intensive sites that come next, which is cracker plants; we have already seen Mossmorran go.

It is those two things. As a nation, we must decide what we want to look like and whether clean manufacturing is important. If so, we need energy and emissions infrastructure that reflects that so that businesses can invest, and we need to recognise that businesses invest where they can make money, so the infrastructure must be competitively priced and accessible at the right time.

Lorna Slater: Understood. I turn to the credibility of negative emissions technologies. As I understand it—I am happy to be corrected if I have misunderstood—there are, in essence, two flavours of negative emissions technologies. In one version, you would attach an interim measure, perhaps a chemical process or a reverse process, to a specific installation to deal with the emissions of that specific site. The other version is a bit more hypothetical, whereby you would take those emissions and stuff them back under the North Sea and hope that they stay there. Have I got that right, and how credible are the two pathways? I heard Professor de Leeuw talk about negative emissions technology as an interim solution. I would agree with having that as an interim solution for key industrial sites until we can get electrification going, but I am very sceptical—because it has not been proven—about the idea of long-term carbon storage under the North Sea.

Richard Woolley: I think that you were coming back to me—is that right?

Lorna Slater: The question is to both of you, but please start, Mr Woolley.

Richard Woolley: Sure. I am not in the carbon capture and storage industry, and I am not an expert in long-term geological storage. However, in the chemicals industry, we see that as the least valuable place to put the carbon that has been captured. You have already extracted it from the ground and it can be used to make new products instead of extracting more fossil gas from the ground. You can use it to make things; you can capture it and use it, which is end-of-pipe capture. Whether it is a long-term solution, I do not know—obviously, in a world in which you are no longer burning fossil fuels, what are you capturing? These are very long-term questions, but, in the immediate here and now, it is one of the obvious solutions to prevent carbon from getting up into the atmosphere. If you are doing so, use it for something to create added value for the economy, because that will displace emissions coming from new linear fossil fuel extraction. That is end-of-pipe capture.

If you are talking about drawdown from the atmosphere, in the UK—UK rather than Scottish policy is my speciality; apologies if I always talk about UK policy—there is an emphasis on waste incineration and, now that that has been brought into the UK emissions trading scheme, there will be an emphasis on catching emissions from incineration. Residual things that cannot be recycled or are not recycled for whatever reason will, for a long time into the future, be burned, so we should absolutely capture the emissions from waste incineration plants and, I would argue, use them to make new products instead of burying them. However, I am not from the carbon capture and storage industry and I do not understand it as well as other experts would.

Professor de Leeuw: I have a few things to mention. First, from the global and UK perspective—the UK is a bit of a microcosm—I

note that 70 to 75 per cent of the primary energy that we use in this country and in the world comes from hydrocarbons. Whether we like it or not, that is our starting point; we all have net zero as our destination, but that is the starting point. My argument is that carbon capture and storage is hugely important because, as we transition the world, the UK and Scotland to a lower-energy future, we do not want to put those emissions into the air if they can be captured.

There is a whole bunch of technology in carbon capture and storage, but, in the interests of time, I will pick the two big ones. The first one is where you capture emissions at the point where they are generated; you literally put it on the back of a gas-fired power station—in other countries, a coal-fired power station—take the emissions and store them. The other one is direct air capture, which I will come back to in a second.

Why do I think that it is important? It is working, although not many plants are working. There is a plant in Norway that has been working for many years and successfully capturing emissions. The technology is there. It is expensive, because you need to put a price on the carbon. It goes back to the business case: companies only invest if it makes money. Is it doable and is the technology there? Yes. Are the economics there? No; that will need support, but that is not unusual.

As I said, the other method is direct air capture, whereby you literally capture the air. Why is that tricky? In explaining, I will give round numbers because I do not have all the numbers in my head. Carbon in the air is roughly 430 parts per million—again, the numbers go up and down, so forgive me. To put that into language that we all understand, 0.04 per cent of what is in the atmosphere around us is carbon, so you need to treat an awful lot of air to get the carbon out. That is a really big element of the problem—it is a volume question to get the carbon out and then store it. The best and most efficient way is to capture it at the point of release, which is why there is a lot of focus on that.

When it comes to new technologies such as electrification, solar and wind, the saying is, “The cavalry is coming” and, if you think about it, it is coming. We have done more solar in the world in the past three years than in the previous six decades. Wind storage is also developing. It is coming, but it will take time, investment and implementation. In the interim, we need solutions to ensure that we do not put the emissions into the air from the primary energy that we use around the world, the UK and Scotland. Therefore, carbon capture and storage is part of the solution.

When you have decarbonised the input, you no longer need to decarbonise the output, so it is really important that we do that. At the moment, however, we need to focus on both decarbonising existing processes and taking the carbon out of what is already in the air.

Lorna Slater: My final question to the whole panel—anyone should feel free to come in on it—is a general one about credibility. Does the climate change plan from the Scottish Government look credible? I note that, in several cases, it is kicking the can down the road a bit compared with what the Climate Change Committee has recommended—starting later and catching up later. Is that credible? Is it more realistic? Are we on the right track here?

David Thomson: If you look at it from the perspective of the food and drink industry and food and drink businesses, there is significant pressure on the supply chain already. Supermarkets, wholesalers and others are making demands on their suppliers, manufacturers and farmers on what their plan is to halve emissions by 2030 and reach net zero by 2040, because that is what the supermarkets have said. We work with lots of businesses, and we have many that are grappling with that as the buyers ask them those questions.

You are right to say that that leads to investment in businesses and a range of ways in which businesses are adapting. However, those businesses would struggle to see how the activities that are set out here are accelerating their path or helping them. They would probably struggle to see where, as we have discussed on this panel, there is a link between the plan and the actions, whether financial support, policy support or legislative support, that will help businesses make the change more quickly in order to stay on supermarket shelves. That is the big fundamental question that we would ask of the plan: how will it help us?

Professor de Leeuw: As I said in my introduction, I think that this is an emissions reduction plan, not a climate change plan, because it does not talk about resilience, adaption and all the other bits of what we need to do. Again, think about what is happening. If you think about the electricity system, what we need to do to deal with all the weather elements—I live in Aberdeen—which is a resilience issue, the water system and the need to adapt our sewage systems, and all that stuff, none of it has cash allocated in the plan. It is an emissions reduction plan.

There is still an opportunity to add to the plan. There is a consultation, so there is an opportunity to add things to the plan. We need what I call a Google translate function that will basically say, “Okay, we have a plan here, but what will it actually mean for businesses?” That is what David Thomson, Stacey Dingwall, Richard Woolley and Karen Turner described. We need to build a

Google translate service saying, “Over the next five years, this is what will happen naturally. The oil and gas sector is declining, we see other things being closed down and we do not need Government intervention.” Where we do need Government intervention, you should be really about clear what it is. The Google translate service is something that maybe needs to go back into the consultation to say, “Okay, these are the specifics that we need to do.” Business likes specifics; business likes really clear elements. Government sets a policy regulation framework and business delivers; it is not for Government to do that. That clarity would help a lot of the businesses. However, as I said before, I would prioritise it: do not do everything, everywhere, at the same time. It is just too overwhelming. It is not really a clear focus. That is what I would add to the plan.

Stacey Dingwall: Overall, when it comes to credibility, we are starting from quite a low point. I said that a majority of our members will not be aware of policies and plans around this. What they will probably be aware of is that we have missed quite a lot of climate change targets. They will be aware that the heat in buildings bill has been dropped; that can has been kicked down the road as well. I do not think that there is anything in here that will change that.

To go back to your point about making the distinction between the large emitters and small businesses, that was our main problem with chapter 7 of the draft climate change plan, which is the chapter that looks at negative emissions technology. There is still not enough of a distinction made there between the two. If you were a small business reading this plan, you would think, “The Government still is not getting what it means for me and my business and is not making a distinction between large and small.” In terms of credibility, if I am looking at it as a small business, I do not think this plan moves us on, unfortunately.

Lorna Slater: Thank you, convener.

The Convener: Can I just add that I am very much enjoying Professor de Leeuw’s analogies? We have had the Ikea flat-pack instruction manual and now Google translate as the solutions in this area. I am looking forward to hearing what further analogies we get.

Murdo Fraser (Mid Scotland and Fife) (Con): Good morning to the panel. Before I ask about the issue of costs in more detail, I want to pick up one point that arose from Lorna Slater’s questioning, particularly when Richard Woolley mentioned the chemical industry.

10:30

I represent Mid Scotland and Fife. Twenty-five years ago, paper making was a very large part of the local economy in Fife. There were large companies such as Tullis Russell in Glenrothes, which was a major employer. Those have all gone now, and they have gone because of high energy costs. Just as Richard Woolley referenced for the chemical industry, we have seen the same in steel making, metals and other industrial sectors. We have not stopped using those items: we have not stopped using paper, metals or chemicals. All that we do now is import those components from other countries, so the net emissions from those industries have not gone down. We have made ourselves look good, because our emissions have reduced, but all that we have done is export them to other countries, and we have lost the jobs and the investment that came with those industries.

Can somebody explain to me what the benefit is of exporting our carbon emissions to other economies if we are still using the products? Lorna Slater was talking about large emitters. We could get rid of large emitters tomorrow and just close them down. That would make us look good and it would reduce our emissions, but it would not do anything for the planet or for our economy. Does anybody want to disagree with me?

Stacey Dingwall: I will not disagree. I could not get into what the benefits are, but it is not just employment that is lost in the area; it is the supply chain opportunities for small businesses that are lost when those industries go. It cannot just be as black and white as getting rid of the large emitters, because there is a knock-on impact. Grangemouth and Mossmorran have been touched on; the wider small business supply chain is hugely affected by those large organisations going. That is another point to consider.

Professor de Leeuw: This conversation is very much live in the UK and Scottish oil and gas industry at the moment, because it is a classic example, exactly as per your question. As a country—numbers fluctuate a little bit—we consume around 2.5 million to 2.6 million barrels of oil and gas equivalent a day. We produce about 1 million, so 40 per cent comes from the UK and we import 60 per cent—again, it fluctuates a bit. We are accelerating the decline in oil and gas and basically taking away our supply chain and our jobs, and importing oil and gas. Demand has not gone away. It is a classic example of what you described in history. History is repeating itself in what we are currently doing in the oil and gas industry. That has consequences, because whatever we do not produce here we will import, often at a higher carbon footprint, depending on where it comes from, particularly if it is liquefied

natural gas from the United States or from Qatar. We are repeating that pattern.

A part of good policy and policy making is thinking about this. Richard Woolley already asked what kind of country we want to be. How do we ensure that we keep the wellbeing and welfare of our people in mind and keep the jobs and the value here? Having an industrial base with high-quality jobs is hugely important. We are risking that by repeating that pattern. There is a fundamental question in my mind when I read the documentation. It is not all about emissions—it is about the economy, it is about the jobs and it is about the social fabric of our society. It is all those elements.

I worry when I see Mossmorran and Grangemouth going and we see the oil and gas industry disappearing or declining. We are taking industrial capacity out, but we are not replacing it with something else. That is a very worrying element, which for me sits in this conversation. It is not all about emissions reduction. It is about the holistic balance of what kind of Scotland we will see in 2035 or 2045. When we sit here 19 years older than we are now, will we be proud of what we have achieved?

David Thomson: I will build on that from a food and drink perspective. There is no net zero without food and drink in Scotland, but there is a real question about what we want to produce here: do we want to continue producing the same quantity of things? What does Government policy suggest that we should do? That is why the adaptation bit is very important. That is why we must understand the needs of the businesses, large and small, that are already here and making the food and drink that we are so proud of. Do we want to keep doing that? Some of the paths that we might take on net zero or on climate change might lead to very different solutions from what we have now. That is a very live concern here and that is why we are doing work across the whole industry to try to understand that and to drive as much reduction in emissions as possible, but in a way that is working with the industry rather than towards its demise.

Professor Turner: This gets to a central point. I find this frustrating. When we hosted the climate change conference of the parties in Glasgow in 2021, I wrote a blog about the dangers of offshoring. Coming out of the conference of the parties in 2025, I was more or less writing exactly the same blog, but the industrial installation was changing because the announcement about Mossmorran had just been made. What is interesting about this plan is that, as the Climate Change Committee has done, it talks about the costs of climate change for the Scottish economy. Yes, that is important, but it is the costs of global climate change that are important too.

The frustrating thing is that we could do everything that we want to do and we could get our own emissions down to net zero but still face those costs of climate change if emissions elsewhere in the world were not coming down. We need to think about what Scotland's place is in this. When we have sections of the plan talking about the economic opportunity of net zero, that is what we need to be seizing. We are not going to stop climate change with what we do. We will do our share, and it is important that we do that, but, from a Scottish perspective, we need to look at the wider system.

I am an economist, and that is how I came into this. How do you achieve a well-functioning, prosperous economy with high-value jobs and people earning income so that they can pay their taxes and businesses can prosper? That is our conundrum. How do we achieve that for Scotland? We need to retain and create new, high-value jobs while also getting our emissions down. The language about offshoring emissions is what gives us the problem when it comes to the cost of climate change if we are offshoring jobs and gross domestic product. That is why the question that was put by Murdo Fraser is so important. It is the challenge that we have here. Our climate change plan needs to interact with our industrial plan and our economic plan in terms of the points made about when we get the finances, whether the Scottish Government will support it and how we do it on a multiyear basis. It gets to the crux. This is a bigger problem than having a climate plan or an emissions reduction plan. It is really Scotland's future plan that we need to look at.

Richard Woolley: It is jobs. These are careers in science and engineering. There are scientists and engineers I know who lost their jobs all over the UK last year. Those were jobs making things that we are now importing from China. Europe used to dominate the chemicals industry. Twenty years ago, it was a global power and now it is a fading force, at best. The country that has benefited is China. China now dominates the global trade in chemicals. China has taken all the jobs that we have lost and makes all the things that we now buy. We are losing high-quality jobs and skills and we are losing capability—capability to support our own resilience. These are things that you may not notice from day to day, but, as soon as a pandemic comes along, we are the people who are making the personal protective equipment, the disinfectants and the medicines. We had national champions such as AstraZeneca coming up with a global-first vaccine. These are very important things to have as national assets, and I think that they have been undervalued.

It is research and development. The industry makes up 20 per cent of business R and D spend. It is huge. If we lose this, we are losing innovation,

we are losing patents and we are losing new technology. Paul de Leeuw made a good point. One of the key reasons is that we are trying to do everything all at once. It is very expensive to do that. It goes back to one of the first points in this meeting, which is the fundamental point that we need competitively priced, clean electricity. That is how you make the transition to a new technology, not by undermining existing assets and not by making what we currently do expensive. That just drives up the cost of living for everyone and drives business away.

What we need to do is focus on how we make the new the cheapest thing, because that is when everyone moves en masse and says, "I do not want a gas boiler, because a heat pump is cheaper." That is what we need to target. That means action on the price of electricity to drive it down to where it is not just competitive with UK gas but competitive with Russian gas and US gas. We need to be targeting a very cheap and clean electricity system. If we can do that, everything else moves and, to be honest, you do not need the rest of the policy. Get electricity right and everything follows.

Our industry is slightly different in that we use hydrocarbons as a feedstock, but we can use electricity to make alternative hydrocarbons. The point about electricity is fundamental. I go back to my original point, which is that we support the comments that you make in the climate change plan on electrification and the need to drive down the electricity price. However, we respect that it requires national policy action. There are other national institutions such as the National Energy System Operator and the Office of Gas and Electricity Markets involved and there needs to be a collaborative discussion with all parties to get that done.

Murdo Fraser: Everybody has referenced costs. I want to ask a bit more about the costs in the climate change plan, because it is a statutory requirement that the plan must set out an estimate of the costs and benefits associated with the policies, broken down by reference to the period covered by a Scottish carbon budget in which those costs and benefits are expected to rise. The legislation is quite clear as to what the plan should say about costs and benefits. Does anybody have a view on whether the plan that has been published adequately addresses that? Paul de Leeuw, you are smiling.

Professor de Leeuw: I do not know, because it is not in there. It is hard to judge something if it is not there. The detail is not there. Thinking back to the Google translate function that I talked about earlier, we need to know what is in there to do that.

The other thing is that it is quite tricky to say. I am sorry to use slightly technical language again, but, when you do these big projects, until you go out to the market and ask, "How much does it really cost?", everything is an estimate, and estimates involve big ranges, particularly for big capital projects such as upgrading the grid, changing the energy system and building all these wind farms. The range of the cost might well be anything up to 50 per cent. You, as a committee, need to go back to the officials who wrote this thing, and who know the details behind it, and ask what is behind the plan, because that is not visible, certainly to people like me.

Additionally, what is the range of uncertainty around the costs? One thing that we see—particularly in the wind sector, but in other sectors, too—is that what the cost base was two or three years ago is very different from what the cost base is now. It has multiplied quite dramatically, and for very good reasons. If the cost is given at 2025 prices, is that clear? I do not know. I do not know the level of detail, and I do not know the range of uncertainty around the cost. That is something for the consultation process and for the committee to take back to those who wrote the original document.

Murdo Fraser: Karen Turner is nodding away. Do you want to add to that?

Professor Turner: When I was reading the plan, I could not see what was underlying the costs. For example, tables 1 and 2 show the costs and financial benefits, but I do not know how to read that information. So, my answer would have to be that, no, I do not understand the costs and benefits. There are quite strong assumptions underlying them. As Paul de Leeuw said, having that cost range means that we have a lot of uncertainty in this space—it ranges from low to high and covers what the costs are under different circumstances and things like that. There is not enough detail on the costs and benefits and what underlies them, and I do not know how to read them either.

Murdo Fraser: Thank you. Maybe I could turn to Stacey Dingwall and David Thomson, who are representing industries. I imagine that your members want to do the right thing. They want to decarbonise to help the planet and reduce costs. Do your members have a sense of how they will be able to afford to pay for that and who will help them do it?

Stacey Dingwall: No. I will say what I was going to say to your question about costs. There are a number of references to Business Energy Scotland, which I know is already in operation, as being a key source of support for SMEs in providing grants or loans. That support already exists. However, I hear from members that, when

they contact Business Energy Scotland to try to get support, it can be a couple of months before they hear back about getting that ball rolling. I know that that is not because Business Energy Scotland does not want to provide support; it is just that it does not have the resources. This plan makes it look as though there will be a bigger role for agencies such as Business Energy Scotland, but there is no information as to how its resources and funding will be increased so as to be able to provide that support.

So, no, I do not think that we are any further forward with a funding or support landscape for SMEs as a result of this plan.

10:45

David Thomson: I agree with Stacey Dingwall. It depends on the segmentation of businesses. Larger businesses have plans and they know where they would like to invest, but they are fighting for the investment, potentially against businesses in their own company but in different countries. Therefore, the investment case becomes very difficult, with the electricity costs so high. For smaller and medium-sized enterprises, there is a raft of support available to help people understand what net zero is, and so on, across chambers of commerce, the enterprise agencies and others. However, when it comes down to, "What do I need to do as a business, and can I get some support to do it?", as Stacey Dingwall said, it is very hard to get any reasonable answers quickly. We see things such as the industrial energy transformation fund, which has supported a small number of businesses, not being available for most of the year and not having a long-term focus. There is no clear idea of how businesses will be supported or advised.

Sarah Boyack (Lothian) (Lab): It has been a really good discussion so far. I would like to move on to how the plan—the extent to which it is a plan has been questioned—links to other Government policies. I will pick on a couple of them. One is about the new industrial decarbonisation programme, which is critical. It is the single biggest driver of reduced emissions in this section of the plan. If you look at the stats, it is really significant. Even starting from 2026 to 2030, there has been quite a significant increase in emissions reduction, which is the ambition. However, the details of what that means in the plan are very limited.

To what extent do you think that the new policies in the draft climate change plan will deliver? It references the opportunity to unlock significant industrial electrification opportunities, but where is the detail? What are your thoughts on that in this section of the plan? The new industrial decarbonisation programme talks about a multiyear budget and linking to support for industry to cover a range of decarbonisation technologies to unlock significant opportunities, but there is not much detail. What would you like to see in the plan, or do you think that there is enough in there already? Professor de Leeuw, you are nodding away. Do you have any thoughts on that?

Professor de Leeuw: I agree that the detail must be available. Somebody must have built the numbers on something. You might want to question that as part of your consultation response.

The nature of the intervention tends to be capital activity. If you want to make a change, you have to invest to do something. Investment drives activity and will drive jobs. However, capital activity needs to be planned, and it never happens fast. We see it in the wind industry, we see it in hydrogen and we see it in carbon capture and storage. It will take time.

Going back to the issue of credibility, the plan is now framed around five-year windows. I would go for a rolling five-year window so that it continues, but I would be very clear within that five-year window about what is going to happen, what is already taking place, what is subject to planning and consenting and how fast it can happen. I spent all my working life in various component parts of the offshore energy industry, and my experience is that, when you do these big projects, it takes a long time. You do the front-end engineering and design; you then have a plan; you get approval and consent; and you can then put it into the supply chain and work it. That takes multiple years. If we are saying that we will get a reduction of X per cent by 2030, which is what is currently outlined in the plan, I would like to be shown what is going to be done and what actions are going to be taken, because, without knowing that, it will be very hard to achieve.

The other thing that is very important is to follow the money. If the investment does not go in, the activity does not happen, the jobs will not turn up and the emission reductions are not going to play out. This might already have been done, because the numbers have been built on something, but I would say just follow the money. If the money is not there, investment is not taking place, and then how credible is it? That is what I think is probably worth investigating.

Sarah Boyack: We have seen massive investment in renewables, whether onshore or offshore wind or solar. I go back to the point that money has been invested. What areas need more investment if we are to get the delivery? In relation to the new industrial decarbonisation programme, the figure looks very small—2.1 million tonnes of CO_2 equivalent in emission reductions—but that is the biggest amount in this chapter and it really

grows over the next few decades. How will that be delivered in practice? Professor Turner, do you want to come in on that?

Professor Turner: Yes. I will add to the point that Professor de Leeuw made. There is underlying data. We run economy-wide models in the centre for energy policy, and we know that the estimated costs and benefits can change, depending on the scenario and the circumstances. I would advise that there needs to be some running of the numbers under different circumstances. For example, what might the numbers be if we can get electricity prices down, depending on the interventions? There is the "Who pays?" approach in terms of carbon prices for things such as key emitters. As you say, we need to know where key investment is needed, which, in turn, will affect what the scenarios are.

Offshore wind is very important. We have a lot of wind, which has a potential benefit for us. I have talked about Shetland and the north-east wind sites. It is not clear that all the project developers will go ahead with their projects. What pathways are we anticipating that could be key for delivery for emissions, but also for economic activity, and what needs to be done to make sure that some of the things that we have already invested in actually stay on track? We have done the ScotWind process. How can we keep that on track and make sure that the north-east wind sites come off and that they interact with the Sullom Voe terminal, for example, and what EnQuest and Veri Energy have planned there with low-carbon fuels?

There is an issue around how we can keep what we have already invested in on track, and what needs to be done if something happens with the price of electricity, for example. Would there be a big change, whether that was decoupling from gas or looking at some private line options so that we can pick up excess? There is still an awful lot of "what if" in the area, and I think that there is a need to focus in on things that we are already trying to do. For example, we are still waiting for funding for the Acorn project, but the situation is changing. Investors are nervous, and we are losing key emitters linked to Scotland's net zero infrastructure project that Innovate UK funded around Acorn. We have run scenarios looking at what will happen if we do not have all the emitters. If we take Mossmorran out, leaving us with some of the more central and low-cost emitters, the economic benefit of delivering Acorn and having that CCUS network in Scotland starts to decline. What needs to happen to keep the emitters on board and the investors in the game?

I think that there is quite a lot in there about what we have been trying to do and how we will leverage the maximum economic value and make sure that we get the emissions reduction that we were hoping and looking for.

A key point is something that Richard Woolley talked about. We have an industry in Scotland around chemicals, but we could be using the electricity in other ways to produce other hydrocarbons through low-carbon fuels. What needs to be done to make that happen? Obviously, project willow was an important step. How can we leverage what we have already done with the investment that has been put into project willow and the activity that is remaining at Grangemouth? How can we maximise the benefit of the investments that have already been made?

Sarah Boyack: Another question that comes right off the back of your comments is about joined-up thinking and the green industrial strategy. We have had endless discussions about Grangemouth and, more recently, about Mossmorran. When you look at the opportunities, you can see that they are massive. The Deputy First Minister described the green industrial strategy as a "prospectus approach". There is something about getting that investment delivered and seeing those opportunities.

Yesterday, we had a debate in Parliament on anaerobic digestion. If you had told me before the debate that we had more than 70 plants in Scotland that link food and drink, heat and waste, I would have been quite surprised. Where we have infrastructure, there is something about how we can kick it up to the next level. The green industrial strategy covers onshore and offshore wind, carbon capture and storage, professional and financial services, which we have not yet mentioned, hydrogen—particularly green hydrogen, and potentially at Grangemouth—and clean energy-intensive industries. There are huge opportunities, but how do you get that investment in there? To what extent is the draft CCP consistent with what is in the green industrial strategy? How do you get the elements to join up?

Who wants to kick off on how we get that to happen? Professor de Leeuw, do you want to come in?

Professor de Leeuw: I will make a few observations. You make an important point, but I want to link a few things that are not necessarily linked as clearly in the CCP.

What economy do we want? I particularly look at what is happening in the oil and gas industry, and the supply chain and the workforce that can transfer to offshore wind, carbon capture and hydrogen. We did a lot of work in our report, "Striking the Balance", which we published last year and which I know a number of committee members have seen. We looked at how the decline in the oil and gas industry is happening

faster than growth in the new offshore renewables industries. We are losing more of the supply chain capacity and workforce capacity than we can currently use for offshore wind and carbon capture and storage.

Although the plans are great, we potentially have a risk, particularly over the next five or six years, that, depending on the scenarios, the Scottish oil and gas workforce will halve. That is a big issue, because those are the people in the supply chain who can build the wind industry, the carbon capture industry and the hydrogen industry. It is a real issue. The reason for that risk is that most of the ScotWind developments—that fantastic programme—will not happen until the early 2030s. We see one industry declining while the new industries are not ready. A good green industrial strategy would align those things. We call it the Goldilocks zone: you need to get it just right. As one industry declines and the other one grows, you need to get your timing right so you can take the supply chain and the workforce across from one to the other. If you follow the money, you can see that that is not happening at the moment.

We see the oil and gas industry declining way faster. There are far more people coming out who cannot work somewhere else. We have always lost people from the oil and gas industry. We have had 25 years—a quarter of a century—of decline, so it is nothing new. What is new is that we need that workforce and that supply chain to build the green energy future for the UK and for Scotland. We need those vessels and capabilities to build the wind farms, the carbon capture and the hydrogen. That is a problem. There is a misalignment. One thing that we really want to make sure of when we talk about the green industrial strategy is that we align the dots in such a way that we can use the industrial base of Scotland to build our new energy future.

The prize is massive. In our report, in which we talk about striking a balance for the UK, we say that if we get it right we end up with 40 per cent more jobs, but if we get it wrong, we end up with 20 per cent fewer jobs. If you look at the current trajectory, you will see that we are heading towards the lower number rather than the higher number. There is a massive opportunity to intervene and get the right message across. The issue is hugely important because we cannot deliver the net zero outcome unless we have people in the workforce. Otherwise, we come back to Murdo Fraser's point about offshoring and getting net zero without having an industrial base here. That is a real worry.

These things are absolutely linked, but it is a role for you as politicians to make that link and put an integrated plan in place.

Sarah Boyack: Do we need more clarity? I see that Professor Turner wants to come in. In manufacturing, for example, there are massive developments in onshore and offshore wind, but we do not build the kit in Scotland—we import it all.

Professor Turner: Yes, and it is not just that. I am holding myself back from getting too technical, but we have excellent capacity among the Scottish Government officials who build the input-output tables that describe the structure of our economy. They do that very well—they often do it better than the Office for National Statistics does it. Over the 10 years that we have had the centre for energy policy, a key thing that we have done is come to understand the supply chains. The ONS has produced data around some of the low-carbon activities, such as offshore wind and onshore wind, and what they offer in terms of a multiplier throughout the economy. For every job that you have in oil and gas, how many do you have elsewhere in the economy? The numbers are always low. Electricity tends to do well, but a lot of that is to do with the network. The actual low-carbon generation does not do as well. Part of the reason for that is that we are not building the kit. For example, we are not building the turbines; we are bringing them in. I cannot remember in which industrial dispute this was raised, but a point of frustration was that we can see the offshore wind farms from where we are standing, and we could be building parts for those offshore wind farms, rather than just doing the end-of-stage assembly and so on. We can see the wind farm, but we are not making the kit. It has been shipped across the world, which means more emissions.

11:00

You made the point about financial services. We have analysed the oil and gas supply chain, and a huge chunk of the value, in terms of not only the gross value added but the high-value jobs, is how the oil and gas industry has used financial services in Scotland and in the UK economy. Sometimes it can be difficult to unpick from the data that the ONS produces, but is that big part of the gap in relation to things such as low-carbon energy production? As well as missing out on building the kit here, are we missing out on the link that oil and gas established with our financial services? Another key strength for Scotland is that we have important financial services centres. Are we getting that linkage? All of that needs to come in the interaction.

It is complex to look across industries, the economy and climate issues, but we have analytical capacity with the people in the Scottish Government who do that input-output accounting. They trace all the linkages between sectors of the

economy. Again, we need to see that come through in the information that underlies things such as the CCP, along with what we have and how we could make it stronger. We have produced policy briefs in which we raise that question and make some suggestions, but you could be picking up on that academic research.

The work has been done and questions have been raised. We have pointed to areas that might be important, and financial services is an important one. We often, quite rightly, talk about manufacturing and the supply chain, but what about the role of financial services? Is that sector not being used strongly enough in some of the low-carbon developments?

Sarah Boyack: Those points are really well made.

I have another point that I want to ask about. There are four actions that the Scottish Government has committed to. We have talked about the UK Government reducing electricity costs, and there is talk of tackling the barriers to decarbonisation faced by energy-intensive industries—there has been discussion on that. However, one of the issues is about developing a resource delivery plan, which will identify a target and enable new clean energy-intensive industries to locate in Scotland. What more would you like to see in the climate change plan in relation to the green industrial strategy?

You have mentioned the supply chain. When we talk to the renewables sector, people always tell us that they need certainty and confidence. What more could be in the climate change plan to incentivise people to invest? We have seen some of the national wealth fund impact. Is there more that could be done through the CCP to give that certainty, perhaps through investors in different key sectors, to get the money going and get those industries—whether it is green hydrogen or CCS—developed in Scotland? Do you have thoughts about how the plan could be more helpful?

Professor de Leeuw: Again, if it is all right, I will let my colleagues speak from the perspective of other sectors, but I will speak from an energy perspective. The one thing that we find very clearly in our work is that the oil and gas industry is declining and the renewables sector is growing. Particularly in this decade, between now and the early 2030s, the vast majority of the wind activities will happen not in Scotland but in the rest of the UK, before ScotWind comes on in a big way.

If Scotland wants to win this game, it will have to build supply chain capacity ahead of activity. That is an important point to note because, if that does not happen, things will be built somewhere else. We will never get there and we will lose the oil and gas industry and never build the next generation of industry. Strategic investment in the future of offshore energy will be critical ahead of final investment approval for a project. That will be key. Among all the other important conversations, that will be critical if you want to be in here. It is an important point because the Scottish population is 5.5 million, with a working population of roughly half that. One in 30 people in Scotland currently works for or supports the offshore energy industry; where I live, in the north-east of Scotland, it is one in six. If you lose that, it will have a massive impact.

There is a real opportunity to start making strategic multiyear investment in critical infrastructure and saying, “We want to back this.” You see other countries doing that. It might be investment in big data centres for artificial intelligence or in the wind industry, and it is hugely critical.

From a European perspective, half of the work in European offshore wind will happen in five countries—all the countries around the North Sea. We have to invest at scale, and we are not doing that. We have to do it sooner rather than later because otherwise the work will be based somewhere else. Strategically, there is a lot to be done, but is not in the CCP. That is an industrial strategy question about what Scotland wants to be when it grows up.

Sarah Boyack: It is about that joined-up thinking. Earlier somebody mentioned that we produce lots of electricity, but we are not using it when we produce it, and the constraint cost of is about £1.5 billion at the moment, so—

Professor de Leeuw: And going up.

Sarah Boyack: On a more joined-up approach, you mentioned data centres, but we could be talking about heat. In fact, there are all sorts of opportunities.

I could go on for hours, convener, but I suspect that I should hand back to you to let us move on to the next question.

The Convener: Indeed. With an eye on the time and given that we have been asking questions for 90 minutes, I suggest that we take a five-minute recess and recommence just after 10 past.

11:06

Meeting suspended.

11:10

On resuming—

The Convener: I will resume our questions by handing over to Stephen Kerr.

Stephen Kerr: This has been a really interesting session. There seems to be a coalescing of views from our witnesses. Murdo Fraser's comments on paper making resonated with me, as I spent my entire career working for a big company in the paper-making sector. Gradually, over the past few years, it has begun to withdraw from the UK for reasons that we have hit on time and time again this morning.

We are focused on scrutinising the draft climate change plan. You all seem to be saying the same thing. Just for my understanding, I want to ask you a simple question. Are you saying that, based on what you have said so far, the draft plan is lacking detail on how it would work, how much it would cost and who would pay for it? Those are fundamental elements. I put that to Paul de Leeuw.

Professor de Leeuw: I think that it describes what needs to be done, but it needs—

Stephen Kerr: It does the what.

Professor de Leeuw: It addresses the what and the when quite well. To my mind, all the other elements require greater detail.

Stephen Kerr: The other elements are missing.

Professor de Leeuw: The detail is not there. The cost and timing elements must be built on something; the targets are not random.

Stephen Kerr: That is not evident.

Professor de Leeuw: It is not clear. It might be clear in somebody's spreadsheet, but it is not clear from what has been made available.

Stephen Kerr: Thank you. Stacey Dingwall, what is your take on my summary of what I am hearing? Am I understanding correctly from you that the issues with the draft plan are how it would work, how much it would cost and who would pay for it?

Stacey Dingwall: Yes. There is a lot of narrative in the draft plan, but I think that you are right about the need for detail. The plan covers 2026 to 2040. I imagine that we would need to rewrite it quickly, because, as colleagues have been saying, so much of it is unsaid. The draft plan certainly would not take us to 2040—it is just a narrative.

Stephen Kerr: There is not a lot of time for any further consultation. I think that the consultation closes at the end of the month.

Stacey Dingwall: Yes.

Stephen Kerr: David Thomson, is that a fair summary of what I have heard?

David Thomson: I think so. I think about things through the lens of our members. If our members looked at the draft plan and said, "How will that accelerate me towards net zero?", they would have no idea, would they?

Stephen Kerr: Okay. The draft plan is not helpful in a practical sense.

David Thomson: No.

The Convener: I believe that Richard Woolley would like to come in.

Stephen Kerr: I am just turning to him now. Richard?

Richard Woolley: It depends on whether you want the long or the short of it, but, yes, I totally agree. The draft plan tell us what we need to do. The key policies that are outlined in the section on industrial emissions are unsurprising, but they do not explain how we will deploy those policies and how industry will comply with them.

To add colour to that, one of the key policies is carbon pricing through the UK ETS. Since the UK ETS came in in 2021, our sector has reduced emissions by 40 per cent—all through site closure—so we are well on our way to decarbonisation. That includes Versalis at Grangemouth. I can take these one by one, but I will keep my response brief.

Stephen Kerr: I will come back to ETS, because that will be the thrust of my main question to all of you. However, first, I want to get a sense of where your evidence has led us to and to check that I have understood it. I will turn to Professor Turner, and ask her to give me her take on my summary.

Professor Turner: I echo the others. To put it briefly, there is a lot on the what and the intended timing, but there is very little on the how. I note that if you do not have the how, that will affect all the costs that you are trying to set out. It will also affect the when, including its nature. To echo Richard Woolley, you might get the wrong kinds of emissions drops if you do it the wrong way.

Stephen Kerr: However laudable the aspirations expressed may be, as you have identified in relation to what needs to be done, a plan is not a plan unless—to use Professor de Leeuw's colourful but very pertinent flat-pack furniture analogy—it details exactly how you get from A to B. The convener and I were discussing that analogy during our intermission. We enjoyed that, because it is so illustrative of what needs to happen.

11:15

I was also interested, Paul de Leeuw, in your comments about hydrocarbons and the rate of decline, particularly in oil and gas, because that is a huge issue for the Scottish economy. I know that

we are straying into industrial policy—we have heard that a number of times, and I acknowledge that—but should the CCP include policy signals that are intended to stabilise the decline in oil and gas, in order to allow for the Goldilocks scenario that you were describing? Should there be an explicit reference to our support for the oil and gas sector?

Professor de Leeuw: I will refrain from commenting on any political elements—I will leave that to yourselves. However, fundamentally, if we want to build the right industrial base in Scotland, we must have a world-class supply chain, workforce and ecosystem. We have that now, but it will be hard to reconstruct if we lose it. Other than in the north-east of Scotland, that base does not exist elsewhere in the UK.

What would be part of a good industrial plan? If the renewables agenda is ready and you can enact it, you should do so. In that case, there would be no problem at all. However, it is not ready, so you should sustain the capacity and capability that we have. You must manage the Goldilocks zone really well, because if the capacity, the people and the supply chain are not there when we need that, you will have to compete on world markets and it will be really hard to get there.

It is hugely important that we treat this as a whole-economy issue. It is not a climate change plan and it is not an emissions reduction plan; it is, as one of your colleagues mentioned, an economy plan. This is about industrial strategy at a mega scale. We need to pull all the levers that are available because, if we lose the industrial base, we will not be able to build it again. The ecosystem will go and the people will go. It is not that they will stop working—they will just be active overseas. It is not that there is no investment in oil and gas—it just does not happen in the UK; it goes elsewhere.

We have a world-class system: use it wisely, do not lose it and sustain it for as long as you can until the cavalry is ready with the new activity that is coming in.

Stephen Kerr: That is a fair and clear comment. I was tempting you to be more explicit in what you thought should be included in the CCP, but I respect what you said.

Let us turn to ETS. As a policy, that will be elevated over the next period. There are already baked-in assumptions about the impact of ETS in the CCP, but there is expected acceleration—extension—of ETS beyond the current three sectors that are impacted by it, namely power generation, aviation and energy-intensive industry such as steel making, chemicals and cement manufacturing.

I will turn first to Richard Woolley because he began to talk about the issue when responding to my previous question. You said something about the impact of ETS on your sector. Will you elaborate on that?

Richard Woolley: Sure. The premise of the ETS is that you make emission-generating activities so expensive that people move to the counterfactual, which, in this case, for most of our sector, would be switching a gas boiler for an industrial electricity-driven heat pump. Again, that goes back to the cost of electricity. It is not cheap enough to do that. Therefore, people are stuck on a gas boiler and they are paying a carbon price for their emissions. As the carbon price goes up, it becomes less sustainable, but it is still not cheaper to switch to electricity, so the only answer is to shut your UK site and start to make the product in the US, China or the middle east instead.

A growing body of evidence is accessible to anyone who wants to look. The Department for Energy Security and Net Zero publishes emissions reports in which you can see where emissions reductions are happening and whether that is because a site has closed. In our sector, if you filter for the chemical sector standard industrial classification code, you will see that, since 2021, 40 per cent of emissions reduction has almost exclusively come from site closure or the closure of production lines within a site.

Ineos Acetyls in Hull is the only exception. It is the only site that has managed to decarbonise—it is a huge feat and should be celebrated—and to reduce emissions by 75 per cent by switching to burning hydrogen for heat. The only reason that it was able to do that was because it was previously selling the hydrogen to a site next door for ammonia production that closed once it was no longer competitive. That situation is not replicable.

Stephen Kerr: It is a form of net zero, is it not, where one plant survives because another plant closes?

Richard Woolley: In theory, the ETS works—just not in a world where it is unilaterally done. This is not a UK-only issue; this is replicated across Europe. Ethylene cracking and ammonia production are the high-end energy intensive processes that form the foundation of chemical production. If you google “ethylene cracker closure” and “ammonia production closure”, you will see that sites are closing all over Europe because we have regionally high gas prices, regionally high electricity prices and, almost unilaterally, a high carbon price. As I say, the evidence is there. I am not saying this—it is in DESNZ’s published reports and there for anyone to see.

Stephen Kerr: In those critical sectors, there is effectively a form of deindustrialisation occurring—not just in the UK but across Europe.

Richard Woolley: That is right. It makes it too expensive to use gas, which is the existing technology, and, because it is too expensive to use the counterfactual electricity, they just shut up shop and then we import that product instead. A few months ago, there was a press release on www.gov.uk crowing about a 10 per cent year-on-year reduction in industrial emissions in the UK. I suspect that 99 per cent of that was due to site closure.

The Convener: I have a brief supplementary. On that point, is there anywhere in the world where alternative technologies for cracking—I take this as an example; there are other energy-intensive technologies—are priced competitively with gas-based cracking technology? Is it a feasible scenario to replace that with alternative technologies, or is that not the current state of the art? If it is not, how far away are we from such a scenario?

Richard Woolley: If that question is for me, that is definitely feasible in our sector. It is feasible where you can get cheap renewable electricity, which, as a wind superpower, we should have an advantage in.

The Convener: But my question is whether that is happening anywhere in the world.

Richard Woolley: Yes, it is.

The Convener: Where is it happening? Is it happening where electricity-based cracking technology is cheaper than or priced competitively with gas-based cracking technology?

Richard Woolley: For cracking, it is not happening yet, because there is not an off-the-shelf technology available. That is in development. There are three chemical consortiums that I am aware of that are developing technologies.

However, for ammonia production, for example, electrochemical production is possible. It is happening in places where renewables are cheap. Big producers such as Yara and CF Industries have investments in the middle east and in Australia. That involves making ammonia with green hydrogen, rather than taking the hydrogen out of natural gas, which is the traditional method.

If competitively priced electricity is available, it is possible to do it, and people are doing it.

The Convener: Thank you.

Stephen Kerr: I would be interested to hear from David Thomson and Stacey Dingwall, whose members might not be directly impacted by the ETS, but who will be indirectly impacted by it. Is the indirect impact of the ETS recognised by the businesses that your organisations represent, or is the cost impact unknown?

Stacey Dingwall: I have never had a member discuss it with me. To be honest, I do not think that it is on the majority of our members' radars.

Stephen Kerr: Okay, but I presume that there would be a cascade of economic impacts. There would be some impact on all businesses because of the deindustrialisation that Richard Woolley has described.

Stacey Dingwall: Yes. We have talked about the impact that site closures have on the supply chain—

Stephen Kerr: But, basically, it is not on anyone's radar.

Stacey Dingwall: No.

Stephen Kerr: What about your industry, David?

David Thomson: There are definitely impacts on the chemicals industry that are important for food and drink. Over the past few years, you will probably have tracked stories about a range of things, including fertiliser production, ammonia production and carbon dioxide, which can affect availability in the UK, mostly on a short-term basis until other elements can be brought in.

If it is okay, there is another point that I would like to add. The UK Government is currently consulting on the British industrial competitiveness scheme, which I think that Richard Woolley has provided an ancillary note on. That will allow foundational industries to reduce their energy costs through exemptions from renewables obligations and from feed-in tariff and capacity market costs, which is to be welcomed for those industries. Unfortunately, food and drink is not covered in the industrial strategy, so it is not an industry that could benefit from that policy. We are making a case in the consultation, but given the importance of food and drink to Scotland, the UK Government should perhaps think differently about that, too.

Stephen Kerr: The setting up of that scheme is almost a form of acknowledgement that some of those cost impacts have had a hugely detrimental effect on business prosperity, business creation and business sustainability.

David Thomson: Correct—that is acknowledged in the name of the scheme.

Stephen Kerr: It is. The name of the scheme represents a policy acknowledgment of that.

Professor de Leeuw: I have a few things to add. It is important to be able to put a price on carbon to give the right business signal, particularly on carbon capture and storage,

because the business model does not work without a carbon price.

There are many options, but I will tell you the three main ways of doing this. The first is a carbon pricing system, which is an emissions trading system. That is the most efficient one. It can be corrected for different countries through a carbon border adjustment, whereby an adjustment is made at the border to put a carbon tax on people.

Whatever method is used, it will be a burden on industry, particularly large industrial users, so we need to be very mindful of the cost to industry. In Europe, we have gone for the emissions trading system because it is the most efficient way of putting a price on carbon.

Stephen Kerr: But is it the most efficient way of doing that, in the absence of carbon capture and cheap electricity?

Professor de Leeuw: Yes, but that is the point.

Stephen Kerr: Oh—that is the point. I see.

Professor de Leeuw: If we want to have a system that will work in the future, we need to have a carbon price to underpin the model. At the moment, the carbon price is too low, which means that there is no price signal to support large-scale carbon capture and storage. The view is that the emissions cost will go up and the price of carbon will go up, which will send a signal for carbon capture and storage. There are a lot of "ifs" in that conversation, but that is why the mechanism is coming in. Whatever happens, it will be a burden on somebody. Somebody has to pay for this.

Stephen Kerr: But we are missing the Goldilocks moment that you mentioned in relation to hydrocarbons. There is not a Goldilocks moment here either, is there? We are not getting this right, because we can see—according to Richard Woolley and other evidence that is available to the committee—that the deindustrialisation that we have talked about is happening across the UK, including in Scotland.

Professor de Leeuw: If we get it wrong, there will be a deindustrialisation impact. However, there is an opportunity to get it right. You asked whether the issue is fairly reflected in the CCP. There is a lot more to the story than is captured in the paragraphs in the CCP.

Stephen Kerr: There are missing elements.

Professor de Leeuw: There are missing elements in relation to which an explanation might need to be provided that says how we will deal with the issue over the different periods. There might be different choices to be made.

Stephen Kerr: From a business point of view, the policy can get ahead of the reality, can it not?

Professor de Leeuw: It is a totality. Industrial strategy and emissions reductions are part of the conversation. We need to look at the complete picture, rather than looking only at emissions reduction.

Stephen Kerr: But to maximise the positive benefit, it is necessary to have alternatives available so that we can drive good practice—good behaviours, if you like. At the minute, such options do not exist. We have introduced a policy that creates an impact without offering any means of escape.

Professor de Leeuw: Absolutely. That goes back to the consultation. That question should be considered.

Stephen Kerr: Thank you. I invite Karen Turner to give her input on the discussion so far.

11:30

Professor Turner: I echo the argument that has been made so far. There are two points to make. The first is that, when we are talking about the carbon price, we are talking about social policy and social benefits, so it has implications with regard to who pays for things. The price of carbon itself could be considered as a social cost, in that benefits and disbenefits emerge in relation to employment, a cleaner atmosphere and so on. We are in a situation in which we are talking about the benefits and costs to society, which gives rise to a "Who pays?" challenge. There is a lot of discussion about taxation and part of the burden being borne because that is how society pays for things.

That is the general picture. As Professor de Leeuw said, the carbon price has been too low. If it shot up now, all the companies that Richard Woolley represents would have even more problems. That takes us on to the international picture. The carbon border adjustment mechanism, which is mentioned in the plan, has been a big focus of policy. The principle is for that to act as an equalising mechanism so that everyone pays the cost of carbon and it is not cheaper to move production to somewhere such as south-east Asia or the United States.

However, that is not a simple thing to do, either. We have done analysis of the impact of bringing in a carbon price on things such as imports. Many of our manufacturers import much of their supply chain, so if we were to bring in CBAM as a form of international carbon pricing, that could have implications not only for companies in selling their outputs, but for the import side and the upstream supply chain. We are talking about a complex challenge. It is not something that the Scottish Government or the Scottish climate change plan will resolve.

We come back to the core issue of co-operation. There needs to be interaction with the UK on designing the UK ETS to sit alongside the European Union scheme and on CBAM. When it comes to international co-ordination, we have had the frustration of successive COPs not getting to grips with the nitty-gritty of the how in all of this.

Stephen Kerr: You mentioned CBAM. Obviously, that acronym is interesting in a Scottish context—I am thinking of "Parliamo Glasgow" and all that. As it currently stands, CBAM will not do anything for the chemical industry—it will destroy the chemical industry.

Richard Woolley: It is quite a funny one, because we were one of the sectors that asked for it. We thought that it could be helpful, but, as with all such things, the devil is in the detail. For a long time now, an export mechanism has been lacking in the design. Basically, CBAM was brought in with the idea that it would replace the current carbon leakage mitigation mechanism, which is called free allocation. Free allocation provides carbon leakage mitigation, regardless of where your end product ends up. As we are an export-focused industry, that is really important. For a long time, the carbon border adjustment mechanism was designed in such a way that it did not include an export leakage mechanism, which meant that it would protect companies only when they were selling into the domestic UK market. As that is not a market for our sites, it would just result in them closing.

Recently, there has been a development whereby we understand that we will be able to keep free allocation for the exported product, but it will still be subject to a decline over the next nine years. It is unclear whether that level of support will be sufficient to keep industry here, given we have seen such vast closure over the past 12 months.

There was something else that I wanted to add, but it has escaped my mind.

Stephen Kerr: That is okay. Everyone's contributions have been helpful. I think that it is somewhat ironic that we will, in effect, be resorting to tariff measures to achieve our goal, given the global politics of the past 12 months—

Richard Woolley: I am sorry—I have remembered what I wanted to say. One of the biggest proponents of CBAM was the ammonia sector—indeed, CBAM was brought in to cover fertilisers. However, between concept and implementation, all our ammonia plants have closed. We had three, which have all gone, so it is a case of closing the door after the horse has bolted. The hope is that, in the future, we might be able to attract back some clean ammonia production that is based on green hydrogen. Fingers crossed, that will be the case, but it is funny how CBAM materialised.

Stephen Kerr: Convener, I know that one of our colleagues wants to ask further questions on the subject, so I will defer to Willie Coffey.

Willie Coffey (Kilmarnock and Irvine Valley) (SNP): Good morning. I did not think I would hear "Parliamo Glasgow" mentioned at a committee meeting in the Scottish Parliament.

Stephen Kerr: It was a tribute to Stanley Baxter.

Willie Coffey: That was nice to hear.

As Stephen Kerr mentioned earlier, we probably would not need a CBAM at all if the UK was still within the European Union. The EU has its emissions trading scheme and, as I understand it, the UK has felt obliged to invent its own. The CBAM arrangement is necessary to try to prevent businesses in the UK and the European Union from being disadvantaged relative to one another.

I want to ask our witnesses for their views on the extent to which the UK's ETS dovetails—or works harmoniously, let us say—with Scotland's draft climate change plan. It seems to me that, if the ETS were to fail in any respect, Scotland would have great difficulty complying. Do our witnesses share that view? Does our draft climate change plan recognise that and try to compensate for it? Professor de Leeuw, would you like to start?

Professor de Leeuw: I will defer to Richard Woolley, because I am not close to the mechanisms around how the system between Scotland and the UK works. People in the chemical industry deal with that issue daily, so this one is probably not for me.

Willie Coffey: Richard Woolley, to what extent does the UK ETS work in harmony with Scotland's draft climate change plan proposals?

Richard Woolley: The UK ETS seems to be one of the key policies in the plan in terms of reducing industrial emissions. Several are highlighted in the road map, including CBAM, energy efficiency, the drive for embodied emissions reporting, which involves the emissions that are embodied in imported goods, and a replacement for the IETF. Putting aside the fact that Scotland has its own IETF, those are all UK policies. Another key policy concerns the Acorn project. We desperately need something to come forward on that. It is difficult to keep myriad investors interested in such a complex project over such a long time. People will start to walk away and, when they do, it will be difficult to bring that group back together. Planning permissions expire, permits expire and skilled people leave, so, as I say, the time to act on that is now.

It was unhelpful that the UK Government suddenly announced this summer that it would support only one regional hydrogen network when we had expected it to support all the clusters equally in order to have carbon capture infrastructure alongside hydrogen infrastructure. That surprise announcement leaves even the track-1 clusters on the east coast of England and in the north-west of England in competition for funding for their own hydrogen networks. It does not affect the carbon capture network but, if you do not have carbon capture infrastructure and hydrogen infrastructure next to each other, you will limit the possibilities for the two to combine as feedstock for our sector.

On the UK ETS, as has been said previously, climate policy is devolved. The UK ETS policy making is done by a body called the UK ETS authority, which is made up of representatives of the Treasury, DESNZ and all the devolved Administrations, although, up to now, everyone has basically agreed that DESNZ should write the policy on behalf of that body. We have asked for the Department for Business and Trade to be included in the body as well, to ensure that a wider range of voices is heard in the policy and decision-making process.

Willie Coffey: Professor Turner, our draft climate change plan assumes that the UK ETS will work. Is that how you see it? What happens if it does not? Can Scotland's climate change plan succeed if that does not happen?

Professor Turner: Like Paul de Leeuw, I bow to Richard Woolley's expertise on how the UK ETS is functioning. That is why I said earlier that, in terms of the figures that it uses and even its narrative, the plan needs to look at different policies and scenarios, particularly ones that involve important impacts with regard to what might happen with electricity prices, as well as the wider picture in terms of the determination of the market price.

The situation is similar with regard to the UK ETS. Especially given that that is a reserved policy area, we need to consider how the Scottish climate change plan should react if that does not work or there is a major change. In order to focus on what the Scottish Government can do at this level, we need to have the numbers and narrative in relation to what might happen if something does not function properly or if the situation changes.

Willie Coffey: My last query is on how well the on-going monitoring to advise both Governments about progress towards reaching the targets is working. Who will do that monitoring? Who is best placed to do the monitoring and to revise the plans, targets and schemes and so on as we go forward? Can anyone offer a view on that? Richard Woolley, how will we know that we are achieving what we set out to achieve?

Richard Woolley: I was just smiling because I thought that the question was to do with the ETS. In that respect, there is on-going evaluation of the scheme, which we fed into. We are looking to the results of that because that will be a public record that shows what I have outlined.

In terms of the correct body to do the work, again, apologies, but I am a UK policy expert and my expertise is in national UK policy. In that respect, it is the Climate Change Committee that has an industrial lead, so, from my perspective, the monitoring would be done by the industrial section of the Climate Change Committee. It is its job to hold Government responsible.

Professor de Leeuw: Richard Woolley is absolutely right: the Climate Change Committee has a legal obligation to advise the nations and the nation state of the progress that is being made, but I think that, given that the CCP is owned by the Scottish Government and the Scottish Parliament, there needs to be a body here that is set up to monitor progress on it.

I talked earlier about the need for an emissions control mechanism that is equivalent to the one that the UK has and can tell you whether you are on track. However, if you have somebody to monitor the plan, they also need to have the power to make an intervention. If you have an organisation that has a monitoring framework, you need to have a rolling five-year plan within which it can make an intervention. Just saying, "Oops, we are not on track" is not that helpful, as that just means that the Parliament or the Government has to do something.

If you want to build an integrated plan, you need to have a level of detailed monitoring that shows whether you are on track, you have to enable interventions to be made and you have to allocate money to enable them to be done. That approach will enable you to run the process almost like an outcome-focused activity. It is important that you have a plan, a monitoring framework, the ability to make interventions and clarity around what will be done afterwards. That is part of this conversation, for me.

Willie Coffey: Could Scotland do that almost independently as we move forward?

Professor de Leeuw: From what I understand, that should be totally within the powers that Scotland has.

Willie Coffey: I am conscious, convener, that, when our successor committee has a conversation on this issue in two or three years' time, its members will possibly ask questions about how the situation has progressed and who is

responsible for enabling progress to be made quicker, better and so on. It will be important to have that data at that time, so that we can react and respond positively in a way that ensures that we can develop the climate change plan and take it forward.

I thank our witnesses for responding to my questions.

11:45

Kevin Stewart (Aberdeen Central) (SNP): I hope that folk can hear me okay. I have a number of questions, some of which are about the Goldilocks zone that has been talked about and some of which cover some of the other topics that have been discussed.

Are we nearing the end of the Goldilocks zone for carbon capture, and does the UK Government need to take action much more swiftly to make Acorn a reality or will we see investors give their thoughts about it all by leaving the project? Maybe we can hear from Professor de Leeuw first, please.

Professor de Leeuw: What a question. I think that it is a critical window. The Government has made more than £20 billion available for carbon capture, utilisation and storage over the next couple of decades, so there is a notional allocation—although it does not say that it is going to be used—and £200 million for Acorn itself. However, there needs to be confidence that the project will happen. I have been hearing the Acorn story for years and years. We have now seen that the operator is selling out its position and moving into other places, so, if we want to do something, we need to move fast.

I am personally worried that Acorn is rapidly turning into baby corn. It is one of those moments when you wonder whether it will exist, given the way we are going. If we believe that CCUS is a fundamental part of decarbonising Scotland—which I think it probably is, although we need to make sure that there is still CO_2 to be captured—we need to go after these projects and have full support across the political spectrum, both in Scotland and the UK, to make it happen. We have to just link it in and get the funding to go with it, because it has to be part of the plan and the monitoring framework. It is absolutely critical.

The Goldilocks zone is very important. Let me explain why. Eighty per cent of the oil and gas supply chain can support carbon capture and storage, and more than 90 per cent of the workforce skills we currently have in oil and gas can support carbon capture and storage. It is the most adjacent supply chain and workforce we have both in Scotland and across the UK.

Do I think CCUS is important? Oh yes—it is massively important. Is it going fast enough? No, I do not think it is. We will need the right policy and support frameworks. The skills and supply chain are already there; we just need to go after it now and provide the confidence to invest in it.

Kevin Stewart: In your "Striking the Balance" report, you highlight that, in the UK, one in every 215 jobs is in energy. In the north-east of Scotland, it is one in every six. You have said during this evidence session that we need to retain those skills. There has also been talk of ensuring that the supply chain remains in order to deliver net zero. Do you think that, in terms of the level of investment and the logic of all of this, the UK Government has a real grasp on what it needs to do and that, if it does not ensure that there are changes to retain jobs, retain skills and capture investment, that will make it almost impossible for Scotland to deliver on its climate change plan or, as you termed it earlier, emissions reduction framework? Would that be the case?

Professor de Leeuw: Again, there is a lot in your question. If you do not mind, I will unpack it a little bit.

There are some quite unique things happening, as what happens in the UK is not necessarily what happens in other places. As of the beginning of this year, the UK is the only country in this part of the world with a windfall tax left. That is quite interesting, because no other country in Europe has one in any part of the industry, because there is simply no windfall to tax. That has consequences, because money is still going to be invested in the oil and gas industry, but just not to the same extent in the UK. The money is going overseas, which I think is quite fundamental.

The second thing to note is that the nations around us are changing and have changed their energy policy. Norway has always been very much focused on energy resilience. It is still producing oil and gas that is supporting Europe, particularly post the Russian invasion of Ukraine, but it is using the proceeds of that to accelerate the renewables agenda. Denmark, which is a stalwart of renewables, has redeveloped the Tyra gas field and is self-sufficient in gas at the moment—it is actually exporting gas as well as doing renewables. The Netherlands announced last year that it will selectively develop gas fields in the North Sea to support gas sovereignty, independence and security.

It is quite interesting that we have a unique policy framework playing out in the UK. Again, I am not a politician, so I am not making a political point; I am just making a factual point. What is interesting is where we play our energy policy. That is quite fundamental, because, as I said, we cannot do everything at the same time—we need

to be mindful of that. What we see happening is that wind is slowing down—not the wind itself, but wind activity—and it is moving out in time. Carbon capture is moving out in time and hydrogen is moving out in time. If we want to sustain the supply chain and the workforce, it is really important that we think about that.

The third point that I want to make is that, if we do not produce the gas and we do not have the wind farms, where is the electricity going to come from for the country in the early 2030s? We are pulling out of importing it. That is part of energy strategy, energy security and other things that go with it, such as energy affordability. It is an integrated policy question that is hugely important. The reason we raise the Goldilocks zone is because, as politicians—unfortunately, it goes with your film star wages—you have to manage that, because it is really important that we get this right. If we do not, we will lose our competitive edge.

Kevin Stewart: In terms of striking that balance and ensuring that we do not lose our competitive edge, that should formulate the policies as we move forward. You paint a stark picture, and rightly so. If we do not get this right and if we do not get electricity production up, and if we see gas declining, there is the possibility of us facing energy shortages, is there not?

Professor de Leeuw: Again, I remind the committee that this is an international market. We have export and import opportunities all the time. Will we have an issue? We will just end up importing more if we do not produce it ourselves.

Kevin Stewart: It will increase carbon emissions.

Professor de Leeuw: If we get electricity from France, it will not. If we get gas from Norway, it will not, but if we get it from other places, it might increase carbon emissions. Particularly when we start importing more oil and gas from places other than Norway, we will increase our carbon footprint. This is about integrated thinking and integrated planning, and it is really important that we get this right. As I said, my job is to go out and reduce our emissions on a daily basis, not increase the emissions around the world by just offshoring them.

Professor Turner: Particularly on the point about Acorn, given its centrality to the Scottish climate change plan, but also overall, our research has shown that the economic benefits that we get from having that activity in Scotland will be higher if we can move at pace, although I guess that the full idea of Acorn has fallen away a bit with the closure of Mossmorran, because you are looking at different emitters being involved. I would highlight that the evidence is there. There is work on Scottish carbon capture and storage being done over at the University of Edinburgh; there is work that we have done as part of the Industrial Decarbonisation Research and Innovation Centre, which is based at Heriot-Watt University; and there is the work that Innovate UK funded with Scotland's net zero infrastructure project, which was largely based around Acorn. There is a lot of evidence there for you to go and push, at the UK Government level, to get decisions made on this.

It is also not just about Scotland's emissions. Acorn would constitute an important part of the wider UK CCS system, and it is worth remembering other facilities that we might be getting in Scotland. Up in Shetland, one of the things they want to do at the Sullom Voe terminal is carbon sequestration. That could provide a back-up to Acorn, so it could help to make the system more resilient. Acorn could also have the capacity to provide carbon storage for other areas in the UK and potentially internationally, although there is still the London protocol around that. This is potentially not just about Scotland's climate change plan. Getting the CCS infrastructure into place in Scotland could be important for the wider UK, and if we set it in the context that Scotland potentially has a back-up in Shetland and things like that, it might be a commercial model that would limit the requirement for public support.

There really needs to be a push on Acorn, and I am happy to help anybody out with finding the evidence. There is a lot of research evidence out there to support that argument and go to the UK Government on it.

Kevin Stewart: [*Inaudible.*]—you talked earlier, as have others, about multiyear funding to deliver, because this is all about delivery. My colleague Michelle Thomson was talking earlier about capital investment and the fact that the Treasury has not been great at multiyear funding and has not given the comfort that a lot of investors will require for some of these big projects. Do you think that the Treasury needs to listen more and needs to pump-prime this investment? Beyond that, do you think that the current fiscal framework is fit for purpose or does it need to be changed so that Scotland itself has the ability to put in place multiyear funding to garner investor confidence?

Richard Woolley: Sorry, we missed the first part of your question because you were on mute, so I do not know whether you directed that to anyone in particular.

Kevin Stewart: I am off mute now. That was for Professor Turner, and then we can come back to Mr Woolley and Professor de Leeuw.

Professor Turner: There are two sides to this. One is the co-ordination and co-operation between the Scottish and UK levels and, obviously, the role of the Treasury. The other side of it is that, where

the Scottish Government will have to take action, which will be built into this climate change plan, it has very limited powers. A particular problem is the annual budgeting, in that you cannot commit to more than one year's funding. At the end of the day, how this will be resolved is largely a political question, but where there is responsibility at the Scottish level for developing and delivering on a climate change plan, it would seem that the fiscal system has to operate in such a way that funds can be committed—a lot of this is the capital up-front spending—in a way that will make investors more confident. A large part of that will go beyond one year. Whatever happens, there must be attention to how we can get multiyear funding. Again, with what needs to be in this climate change plan, there is a limit to what can go into it under the current system, in which you cannot commit more than one year's funding. At the end of the day, there is a huge need for co-operation and co-ordination.

As far as the role of the Treasury goes, we interact with the Treasury in relation to our research and understanding what the economy-wide impacts are and the costs and the benefits. It is a complex picture for it to get on top of but, absolutely, there is a role for the Treasury in terms of the allocation of resources. At the end of the day, these are Government departments and it is ultimately down to the co-ordination between the UK and Scotland. The role of the Climate Change Committee was talked about earlier; it has a specific responsibility to the devolved Governments as well as to the national Government. There are academics who are better qualified than I am to talk on governance and how our institutions work, but it would seem to me that there is a huge governance challenge in terms of the co-operation and co-ordination.

If we are talking about a practical step, something that needs to be looked at is the fiscal settlement in terms of what the Scottish Government can commit to in order to build up investor confidence.

Kevin Stewart: So there is definitely a gap there in terms of co-ordination.

Richard Woolley: I totally agree with what Professor Turner says. I reiterate that I look at the UK as a whole but, as has been said, a climate change plan is not a plan without funding to back up the commitments. It is the same nationwide. We are lacking industrial decarbonisation funding. We need it rapidly and we need it to be ensured for a minimum of three to five years.

12:00

With the investment timescales for fuel-switching projects, you are probably looking five years into the future, if not further. You need it to be guaranteed for fairly lengthy time periods with application windows that are extended rather than short and focused on high TRL—technology readiness level—technologies to deploy. We have the technologies, but a lot of money is going on lower TRL to get them up. That is great, but if we are focused on driving emissions down now, the sooner we cut out emissions, which has benefits, the better. How can we give businesses certainty to invest in technologies that we already have? Part of that is grants and competitive grant ratios compared with other industrial nations, but again—I am sorry to keep harping on about this—it is about the on-going operational cost, because there will never be a business case to deploy an industrial heat pump in the UK unless the electricity price allows a business to do so profitably. If we get that right, these things follow. Electricity price means so much in this conversation.

Kevin Stewart: Thank you. I wonder whether I could be kept unmuted during my questions, so that I can intervene.

Can I ask some quick-fire questions about certain aspects of the plan? Obviously, the plan has some emphasis on hydrogen and the Scottish Government has its own hydrogen strategy. The UK Climate Change Committee is not so keen on hydrogen. What are folks' views on hydrogen production, Scotland's part in that and how it can help us reach net zero?

Professor de Leeuw: Again, there is a lot in that question. Does hydrogen have a role in the energy system? Yes, but I think that, at the moment, the applications are slightly more niched than for general application. Hydrogen is a transition fuel. You need to make hydrogen to get it, so you need energy for that. It needs both supply and demand to be created, which will be quite complicated. There is a role for hydrogen, but I think that it is bespoke and it will probably happen in time.

I think that there is a market for using our unutilised wind capacity, Currently, we make curtailment payments, but we could use that electricity and turn it into something more useful, such as battery storage or hydrogen creation. There are some niche opportunities, so I would expect an element to go in there. Do I see it as large scale this decade? No.

Kevin Stewart: Professor de Leeuw, you have talked previously about localised grids. Do you think that localised grids could help create clusters, which could help us to reduce emissions?

Professor de Leeuw: Yes. For the benefit of all the other committee members, there was a big conversation around regional pricing over the past

couple of years and, of course, there is a decision that has been made. One element is that you can have private local grids, for example at artificial intelligence data centres. Private networks already exist in some oil and gas terminals or chemical plants. It could be island solutions or it could be cluster solutions, where we have private networks across Scotland. My understanding is that it is fully within the power of the Scottish Government from a consenting, licensing and doability perspective, in that we are using the capacity that we have in Scotland and not having to worry about the export element because we use it locally. The only consideration is that it cannot connect to the national grid and the national system. There is a benefit for community systems, private systems and industrial systems, where we can use some of the existing power without having to export it.

Kevin Stewart: I wonder whether hydrogen has been thought about a little bit more by food and drink manufacturers. I recognise that there are already some projects under way, but I wonder whether the Food and Drink Federation Scotland and the Federation of Small Businesses have any views on hydrogen.

David Thomson: The FDF is clear that, in general, the most likely change is to using electricity rather than hydrogen for food processing. Again, grid connection is important. If there is no grid connection, or not the right level of grid connection, there might be other options, but I think that we foresee there being a change to electricity, certainly in the shorter term. Maybe hydrogen will be used in the longer term, but again it is likely to be more useful for specific projects or niche projects rather than across the industry in general.

Richard Woolley: Hydrogen is a fundamental molecule for our sector. We see it as a raw material as well as having the potential for high-heat applications, as described earlier. You could use it in a cracker today, changing the burners and so on. It has direct application in the chemical sector and that is captured in the CCC's analysis. The chemical sector is one of the remaining sectors that retains hydrogen as a big part of its emission abatement pathway. We can use green hydrogen molecules that are derived from electricity and water in place of hydrogen that would otherwise be sourced by taking natural gas and knocking off the carbon element. It is fundamental to us. That is recognised by the Climate Change Committee. It has discrete uses: high-heat processes and feedstock.

WIth regard to electrification, the way that the business models have been pursued so far is that sites in the middle of nowhere are basically being encouraged to decarbonise their heat demand by installing an electrolyser, taking electricity off the grid, turning that into hydrogen and then burning the hydrogen. They are losing energy throughout that process, so it makes much more sense for most low temperature processes at dispersed sites just to connect directly to the electricity system and for policy to direct them to do that, rather than put in an electrolyser at a net loss to UK energy.

Professor Turner: I am not an expert on hydrogen and there are probably people you could better speak to about this, but one thing to note is that we have been alerted, as economists, that "hydrogen" is a broad term. You can use hydrogen in the production of other things, such as e-methanol. At the Sullom Voe terminal in Shetland, they are talking about local distribution of hydrogen derivatives for things such as decarbonising the fishing fleet. You need to call in people who are experts on the process, but "green hydrogen" is a broad term. As Richard Woolley has said, it is like a carrier and there can be derivative fuels produced from that. It almost comes to me when I try to analyse it as an economist that it is part of a process. You can see this argument as being hydrogen or not hydrogen—for example, about repurposing the gas grid—but in industrial uses it is about the different things that you can produce. We have ended up using the term "low-carbon fuels" and this might be part of the process.

I would advise that you get some evidence on that, because it can get very "yea or nay" when it comes to green hydrogen, but it is about how it is used in the process to get to other low-carbon fuels and what that could then decarbonise. We have food and drink here, and we have chemicals, but a huge area that we need to decarbonise is things such as transportation in the fishing fleet, which is important in some areas of Scotland, such as Shetland and the north-east.

Kevin Stewart: We could probably have an entire session on hydrogen, and we have missed out things such as sustainable aviation fuel in today's discussion, but I thank the witnesses for a very good session.

The Convener: I would like to ask a few final questions. I have a couple of technical points that I will direct to Professor de Leeuw. On a number of occasions, you have made the point that we need to understand the underlying assumptions, principally about the costs, but I wonder whether that point also relates to the emission pathways. The advice from the Climate Change Committee suggests that we need balanced pathways and for those pathways to be broken down by sector, and the CCP takes a similar approach, but the differences between the pathways that the Climate Change Committee has set out and the ones that are set out in the CCP are not entirely clear. Is that

another area in which we need to understand the underlying assumptions that the Scottish Government has made in order to understand the differentials? Is that a fair point to highlight?

Professor de Leeuw: You have described the position well. I would ask those questions, and I would overlay them with the economic reality. There is a huge amount of demand on Government time to do things, so is what is set out realistic? Are the pathways realistic in the current Scottish context? The world keeps on changing, and there are different scenarios and different outcomes. We should remember the difference between the destination of net zero by 2045 and the journey towards that. This is a conversation about the journey, not the destination. We make choices when we do things, and it is very important to remember that in relation to the scenarios and the pathways.

The Convener: A certain amount of carbon reduction is baked into the baseline—it is assumed that, if there are no policy changes, there will be a certain reduction in carbon emissions on the basis of the current status and of extant activities, but the plan is not specific about those reductions. Do we also need clarity on those assumptions?

Professor de Leeuw: Absolutely. As my colleagues have said, we need to be clear about what will happen without Government policy. For example, the oil and gas industry will decline, and things such as the Mossmorran site and the Grangemouth cluster will change shape. However, the Government has discretion to make choices, through good policies and interventions, to do something about some issues, so we need to be clear about what has been built in.

We must consider the issue in context. The UK accounts for just over 1 per cent of global emissions—Scotland accounts for somewhere between 0.08 and 0.1 per cent of global emissions. What is already baked in will get us down quite a bit, but we must consider the incremental costs of doing the last bit. Again, it is the last-mile question when we think about some of the issues in other industries.

We need to be clear on what is happening. Do we just need to give a positive nudge? What needs intervention? What needs transformational thinking?

The Convener: Do any of the other witnesses want to make any comments about the need for clarity on any of the assumptions or about things that are implied but need to be made explicit in the plan? I do not see any indication that anyone wants to come in.

I have a final catch-all question. We have all been asking questions with the view that tackling climate change is imperative, so we must reduce our emissions—if for no other reason than our economy will need to compete in a world in which other countries are already reducing their emissions and aiming for a carbon-neutral world. However, there are people who will argue that we are simply adding costs to our economy and that it is an error to be pursuing climate targets. Are we all of the view that we must seek to reduce our emissions and achieve a carbon-neutral economy? Do we all agree that that is imperative for the Scottish economy?

David Thomson: We deal with the issue in a commercial sense. As I said earlier, there is direct pressure from supermarkets and wholesalers, which are working on behalf of their customers to ensure that net zero policies are built in all the way through the food and drink supply chain. From that very commercial perspective, achieving net zero is a driver.

We are also aware of the economic pressures that we feel as a result of global events. For example, due to three failed harvests, chocolate prices are three times as high as they should be. There is a range of issues, and they all have a direct effect on our ability to produce foods and import ingredients from around the world. As well as the ethical reasons for action, those are all fundamental signs that the food and drink sector is taking net zero seriously and must continue to do so as we go forward. Yes, we fully agree on the need for the drive to net zero.

However, as I said, it is important that the climate change plan, the actions by industry and the actions by Government clearly work together in a way that supports businesses to continue to make changes quickly, taking account of commercial pressures, because, if that does not happen, there is a chance that we will lose market share and market opportunities. In any climate change plan, we want to see how businesses will be supported in the drive to net zero.

12:15

Professor de Leeuw: I will make a few closing comments. In my mind, the fundamental role of the Government—I will not be able to describe it as well as you could, because you live this every day—is to improve the welfare and wellbeing of its citizens. Whatever we put in place in an emissions reduction plan—whatever we call it—cannot jeopardise those fundamentals. We could get to net zero by basically having no economy and no jobs, so we need to find the right balance between achieving the right outcomes, doing that in the right way and making things work for people.

We must carry society with us. If people do not like the plan because the cumulative impact is too

high so they cannot cope with it, or if businesses cannot afford it, it is not the right plan. We should remember the fundamental principle—if the plan will not improve the welfare and wellbeing of citizens in Scotland and in the rest of the UK, there is an issue. The plan needs to resonate with people. They need to believe in it and feel that they can contribute to it and be part of a just, fair and co-ordinated transition.

The Convener: But we need a plan.

Professor de Leeuw: We need a credible plan that people buy into.

The Convener: That is very helpful.

Professor Turner: I echo what Paul de Leeuw said. This is very much about the journey. Generally, there is political and public support behind the journey to net zero, but it is all about the how. What is the effect on people? People are affected in a range of ways, including through what is happening with the cost of living and with taxation. For example, people have views about the recent budget decision to take some of the green costs out of electricity bills and put them into taxation. There might be broad support for that as a more progressive way of doing things.

However, the crucial issue relates to jobs. That is what people are very concerned about. We see that when we get down to the very local level. As I mentioned, we are working in Shetland, which has had an oil and gas economy. Broadly, people there seem to be in favour of net zero, but they want to know what it will mean for them. As Paul de Leeuw said, we need to find a way of making the transition without damaging the welfare of citizens.

This is the future of the global economy, and I think that that is the argument for Scotland acting. We produce a very small share of global emissions, so we will not solve climate change. However, if we can be seen as leaders in doing our bit and can find ways to make successful transitions, we can have a global leadership role and be able to take society with us.

That is a real challenge, because we have had some unsuccessful transitions. We had one historically with steel and coal, and Mossmorran shut down last year, for example. Some of the shutting down of industrial activity is directly linked to carbon pricing and so on. If it starts to become the public's view that people's lives will be damaged by net zero, there will be a political shift in the arguments about whether we should be trying to get to net zero.

We need to maintain people's welfare, but, ideally, we should be looking to improve it. If we can move early in this net zero world so that better jobs come to Scotland and we have better outcomes, we will take people along with us.

Richard Woolley: The people who work in the chemicals industry are scientists and engineers, so they understand the science of climate change very well. They have children and they live and work in local communities, so they want to tackle climate change. A number of sites closed last year, and I interacted directly with people at those sites who had spent years tearing their hair out in trying to figure out a way to get their business to invest in a decarbonisation solution, but they could not find a way through because the fundamentals mean that such solutions are not possible right now. The net result is that those sites have closed and people are looking for jobs in areas where manufacturing sectors are in decline. That is frustrating and, quite frankly, depressing. Those people want to do the right thing, but they find that they cannot.

The UK economy is feeling it, too, so we need to get the transition right. It is about how we do it, not what we are doing. There are answers available. We need to consider the timing and sequencing of things, and we need to make clean technologies available at a price at which businesses will be willing to invest. If we make the UK a place with competitively priced, clean infrastructure, foreign cash will come flowing in and we will, I hope, have the jobs and the manufacturing capability to show for it.

The Convener: I thank all the witnesses for their contributions over quite a sustained period—they have been incredibly useful. Given its scope, the draft climate change plan is an expansive document that encompasses a huge number of things, and that has been reflected in the length of our evidence session. The session has been hugely useful and very interesting, and you have all given the committee a lot to go away and think about.

12:21

Meeting continued in private until 12:32.

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