OFFICIAL REPORT
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Economy, Energy and Fair Work Committee

Tuesday 2 February 2021

Session 5

The Scottish Parliament
Pàrlamaid na h-Alba

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ECONOMY, ENERGY AND FAIR WORK COMMITTEE
4th Meeting 2021, Session 5

CONVENER

*Gordon Lindhurst (Lothian) (Con)

DEPUTY CONVENER

*Willie Coffey (Kilmarnock and Irvine Valley) (SNP)

COMMITTEE MEMBERS

*Colin Beattie (Midlothian North and Musselburgh) (SNP)
*Maurice Golden (West Scotland) (Con)
*Richard Lyle (Uddingston and Bellshill) (SNP)
*Gordon MacDonald (Edinburgh Pentlands) (SNP)
Alex Rowley (Mid Scotland and Fife) (Lab)
*Graham Simpson (Central Scotland) (Con)
Andy Wightman (Lothian) (Ind)

*attended

THE FOLLOWING ALSO PARTICIPATED:

Dr Diana Casey (Mineral Products Association)
Professor Stuart Haszeldine (Scottish Carbon Capture & Storage)
Cat Hay (Food and Drink Federation Scotland)
Clare Reid (Scottish Council for Development and Industry)
Richard Simon (Element Energy)
Rich Woolley (Chemical Industries Association)

CLERK TO THE COMMITTEE

Alison Walker

LOCATION

Virtual Meeting

Scottish Parliament

Economy, Energy and Fair Work Committee

Tuesday 2 February 2021

[The Convener opened the meeting at 09:30]

Decision on Taking Business in Private

The Convener (Gordon Lindhurst): Good morning, and welcome to the fourth meeting of the Economy, Energy and Fair Work Committee in 2021. We have received apologies from Andy Wightman and Alex Rowley.

Under agenda item 1, the committee will take a decision on whether to take item 3 in private. Do we agree to take that item in private?

As no members have indicated otherwise, we agree to take item 3 in private.

Climate Change Plan

09:30

The Convener: Item 2 is an evidence session on the climate change plan. Our witnesses, who join us virtually, are Dr Diana Casey, director of energy and climate change at the Mineral Products Association; Professor Stuart Haszeldine, director of Scottish Carbon Capture & Storage; and Rich Woolley, head of energy and climate change at the Chemical Industries Association. I welcome you all.

We start with questions from the deputy convener, Willie Coffey.

Willie Coffey (Kilmarnock and Irvine Valley) (SNP): I have a couple of questions for Dr Casey. In your submission, you say that achieving a 43 per cent reduction in industrial emissions by 2032 is a tall order, and that what is left is the difficult stuff. You also talk about the impact of the cement industry, in which I do not have a lot of expertise. Will you explain the particular significance of the cement industry in the climate change strategy?

Dr Diana Casey (Mineral Products Association): Cement is obviously a key ingredient in concrete, which underpins pretty much our entire society. It is a key material that feeds into the construction industry, which is worth hundreds of billions of pounds. We are an energy-intensive industry that uses a lot of fuels and produces a lot of emissions from the breakdown of raw materials. It is particularly challenging to reduce those emissions. Although fuel switching in our sector will reduce emissions by about 30 per cent, there will still be a large chunk that will need to be dealt with. Use of technologies such as carbon capture and storage is the only way that we will reduce those emissions.

Last year, the United Kingdom concrete and cement sector published our “Roadmap to Beyond Net Zero”. We have shown how the sector can go further and be not just net zero but net negative by 2050. The reason for publishing the route map is, partly, to show how the sector can contribute to the ambition in Scotland to be net zero by 2045. We believe that that is possible. We are very optimistic. We have taken a lot of steps already, and the sector has reduced emissions by 53 per cent since 1990, so we are well on our way.

However, the emissions that are left are the challenging ones. Carbon capture is incredibly innovative, but it has not yet been deployed in the cement sector anywhere in the world. There has been a lot of research, particularly in Europe, and the Brevik cement plant in Norway has been given the go-ahead to construct a commercial-scale

carbon capture, usage and storage plant. Work is under way—such steps are possible.

However, the challenge, particularly in Scotland, is that mineral sites are not in convenient industrial clusters where CCUS could be deployed first. If we put capture plants on cement plants, there is the extra challenge of how to transport the CO_2 from the plant to storage or use. That is the key challenge and the reason for saying that meeting the 2030 target could be tricky for us.

Willie Coffey: I was going to ask about your road map. Is it a Scottish or a UK proposal? Where do we fit into it?

Dr Casey: It is a road map for the UK concrete and cement industry. There is one cement plant in Scotland. It is easier for the MPA to represent everybody, because we run into competition issues when we start talking about a single plant. Tarmac, which owns the plant, is a member of the MPA and is fully signed up to the road map. It helped us to produce it and was very involved in showing how we can make sure that it is appropriate for the Scottish ambition.

Willie Coffey: Over the past few years, has the Scottish Government been a wee bit too ambitious in its expectations for meeting the targets by 2032? What do we need to achieve to meet them roughly on time?

Dr Casey: We are optimistic and positive about what the Scottish Government has been doing. It is obvious from the update that the Scottish Government has listened to industry and introduced changes as a result. A lot of funding has been made available to help industry to decarbonise. Cement, like a lot of energy-intensive industries, is traded internationally, so competitiveness is a real issue. If we push to go faster and further than our competitors in other countries, we might meet the climate change plan ambitions by deindustrialising rather than by decarbonising.

There are two things, off the top of my head, that we would love to see. First, the funding that has been made available is very welcome, and I hope that it will help to accelerate investment. The problem is the on-going operating costs, for which there is less support. For example, CCUS could double the cost of cement production, and competitors in other parts of the world do not face such considerable costs. If there was a way of introducing support for those on-going costs, that would help to make Scotland an attractive place to invest in decarbonisation.

Secondly, the plan lacks a net zero target for consumption emissions, which could help Scotland to do really well. Such a target would ensure that Scotland addressed emissions from the products that it consumes as well as those that are produced here. It would ensure that we meet the targets through proper decarbonisation and not by exporting the problem to somewhere else. We know that Scotland is a world leader by having set a target of net zero by 2045, but anywhere that we export the problem to will not deal with emissions in the way that Scotland could. Setting a consumption-based target, alongside the territorial one, would go some way towards ensuring that we deal with the problem in Scotland and do not just export it elsewhere.

Willie Coffey: That is lovely. Do the other two witnesses have any comments?

The Convener: I should have said at the outset that the member who is asking questions might ask whether other witnesses want to contribute. If you do, please type R in the chat box, which is the easiest way to let us know that you want to speak, but do not feel obliged to do so.

Willie Coffey: I would like to ask the other two witnesses the question that I asked Dr Casey. Is the Scottish Government's optimism about our targets for 2032 well placed or misplaced?

Rich Woolley (Chemical Industries Association): I agree with everything that Diana Casey said.

I represent chemical and pharmaceutical operations in the UK. The association has about 15 member sites in Scotland. The main cluster is at Grangemouth; we also have a couple of sites at Mossmorran and others that are dispersed throughout the country. We directly employ about 6,000 people and pay an average wage that is considerably greater than the average wage across Scottish industry. We also indirectly support a further 8,000 jobs.

We welcome the ambition in the Scottish plan. What matter to us are the details of the schemes and how they support that ambition.

We welcome the plan because we are fundamentally a net zero industry. Roseanna Cunningham, your cabinet secretary for the environment and climate change, yesterday announced funding of £1.6 billion for energy efficiency in buildings. Insulation and the gases that are used in double glazing are chemical products that will supply that energy efficiency. More broadly, wind turbine blades are made of lightweight and therefore transportable composite plastic—that is facilitated by the use of chemicals. New net zero fuels—ammonia, hydrogen and synthetic fuels—and batteries are all chemical products. We have a bright future in Scotland and the UK. We welcome the ambition, but we need support to get there.

There is a lot to like in the plan. We appreciate the recognition of the need for a just transition for

industry that does not leave anyone behind. Energy-intensive assets are described as "strategic". Much is made of the importance of maintaining jobs in Scotland and of mitigating the risk of carbon leakage if we move faster than other countries.

I support what Diana Casey said about setting a target for consumption emissions. In the sixth carbon budget, the Climate Change Committee said that the only way for industry finally to move to an economically viable decarbonisation model is by passing the cost of that decarbonisation on to the end consumer. The committee recommends carbon border tariffs and minimum carbon standards to help us get there. I realise that some of that falls outside the Scottish Government's remit, but we appreciate this Government's call to the UK Government for action in that area and its promise to work on procurement, which will be another important driver of low-carbon markets in the UK.

Diana Casey talked about some ways in which industry can decarbonise. We are similar to Diana's sector: we have both energy and process emissions. A lot of our energy emissions have been decarbonised by electrification, but we have some very heavy, high-heat processes that require either carbon capture, usage and storage or a switch to the use of hydrogen for fuel. We have some process emissions that also require CCUS. We welcome the new funding for CCUS and hydrogen, as well as the calls to the UK Government for a roll-out of business models that support those new industries. We are working closely with the UK Government on those business models.

Willie Coffey: Perhaps Professor Haszeldine could comment on that point. Are we optimistic about 2032?

Professor Stuart Haszeldine (Scottish Carbon Capture & Storage): I share the optimism and enthusiasm of the other two witnesses. Having intermediate milestones in 2030 and 2032 is essential because that grounds our activity in real time rather than deferring it until much later.

Of course, all that initially depends on developing carbon capture and storage and hydrogen, both of which are dependent on funds and activity for the UK as a whole that are not directly under the Scottish Government's control. However, I have to say that the enthusiasm, commitment and direction of the Scottish Government are absolutely essential, because that takes away any doubt whatsoever in those industries and investors about whether the Scottish Government is committed to doing whatever it can within its powers to ensure that the industries of carbon capture and storage and hydrogen generation get developed on time.

09:45

I suspect that, by 2032, we might not have done all the activities that we need to, purely because it takes a while to build the amount of industrial facility that will be required to generate hydrogen or the renewable electricity that will be needed. It would be useful to come back to hydrogen later on in this session. I agree with what is proposed and I am very enthusiastic about it.

Willie Coffey: I thank all three of you for your contributions.

Graham Simpson (Central Scotland) (Con): My questions are directed to Professor Haszeldine and Rich Woolley. First, why do you think that there has been an increase in greenhouse gas emissions from sectors such as chemicals and petrochemical production between 1990 and 2018? I ask Professor Haszeldine to start on that.

Professor Haszeldine: I am not going to give you a very good answer, because I am not part of that industry.

One aspect is that measuring everything on a year-by-year basis can be misleading, because we are interested in the overall trend of decrease. Clearly, the big gains are to be made through efficiency—particularly efficiency of housing—in heat provision and through switching from methane to hydrogen.

I will defer to Mr Woolley about the chemical industry and the details of how different sites can be decarbonised, although I point out that we have a membership of 30 industries in the nexus—in effect, the CCS business organisation that we have created in Scotland—so we have more membership from across the sectors and all of industry than is the case anywhere else in the UK. However, I cannot answer the exact question about the increase in emissions.

Graham Simpson: That is fair enough. Mr Woolley, would you like to say why you think there has been an increase?

Rich Woolley: I am afraid that I will not be able to give you a satisfactory answer, because the data that we have shows a significant decrease in that period. We use data from the national atmospheric emissions inventory, which shows that our sector has had an 82 per cent decrease in greenhouse gas emissions between 1990 and 2018. At the same time, we have increased our production by 40 per cent, according to the Office for National Statistics. Therefore, I am afraid that that answer will not be satisfactory for you. It would help to know where you got your data from. Perhaps I could follow up with written evidence on

the national atmospheric emissions inventory, which is of course what the UK uses to report in relation to the United Nations Framework Convention on Climate Change, so those are our official statistics.

Graham Simpson: We can get back to you on that, and you can provide us with a more detailed answer.

I will stick with you, Mr Woolley. I am pretty sure that you mentioned Grangemouth. According to what we have been told, it is responsible for 30 per cent of Scotland's industrial emissions, which is quite high for one place. Could the Government or the operators there, such as INEOS, do anything more?

I am aware, because I represent that region, that work is being done at Grangemouth to reduce emissions, so my question is not a critical question. I know that stuff is going on around energy from waste, for example. I also know that there is a plan to create a district heating scheme in the town of Grangemouth using waste heat from the Grangemouth site—that has not gone forward yet, probably because of money. Stuff is going on, but could more be done, in your view?

Rich Woolley: Absolutely. Chemicals is fundamentally an energy-intensive industry; you cannot get around that. However, that does not mean that the industry is energy inefficient. Energy is our largest operational cost—the laws of thermodynamics mean that we need to use a certain amount of energy to create chemicals. That is just the physics behind it: we are always going to use a lot of energy.

We could decarbonise that by fuel switching to hydrogen—[*Inaudible*.]—energies or by fuel switching to electricity. Unfortunately, at the moment, there is no business case for doing so because we compete in an international market on price. Any investment in electrification or hydrogen—[*Inaudible*.]—a significantly higher on-going operational cost, which means that it is just not an attractive investment for any company, let alone the multinational companies that we get in energy-intensive industries. They would much rather put that money into another country where they could expand operations and make more money. That is just the economics of it.

What we need from Government is the support to create an attractive business case for low-carbon ways of manufacturing products. Two of the really important things that are picked up on in the Scottish climate change plan are, as I mentioned, the business models for hydrogen use in industry and for carbon capture, usage and storage. We regularly engage with the Government around trying to get the models to a point where we can get a viable business case together to have energy-intensive industries in the UK rolling out those technologies ahead of the rest of the world.

However, the sad fact is that, without that public support, there is no business case for that, so investment goes to assets overseas where more money can be made, rather than low-carbon investment being made in the UK.

Graham Simpson: You represent an industry that has been very well-off over the years. There are companies such as INEOS—I am not singling out INEOS, but it is at Grangemouth. There are big, big companies with lots of money. Why should it be up to any Government—whether the Scottish Government or the UK Government—to fund a switch to other technologies when those companies are well able to at least partly pay for that themselves? Why is that Government's responsibility?

Rich Woolley: I totally get what you are saying. I would say that it is not up to the Government to fund it; the question for Government is whether it feels that it is worth while having these industries in the UK, because the private sector invests where it can make money. At the moment, there is no business case for having low-carbon chemical manufacturing in the UK. The cost of electricity is too high to do it with electricity and the cost of carbon capture is too high to compete.

We are not saying that it is the Government's responsibility to provide the funding. However, if the Government is interested in having the assets in the UK and attracting the energy-intensive industries of the future, such as wind farm manufacturing and green hydrogen production, we need support to have them in the UK, given our high electricity prices, otherwise the investment will go elsewhere. A lot of the major green hydrogen projects that have been announced recently have not been in the UK, despite the UK's emphasis on driving change in that area.

The industry does not want to be reliant on Government handouts in the long term. It wants a pathway to pass the cost of decarbonisation to the end consumer. That goes back to Diana Casey's earlier point, which I supported. Policy allowed the power sector, which has a captured market, to pass the cost of its decarbonisation to the customer—the end consumer of the energy. Our industry will not be in the same place until it can do that, too. It needs to be able to pass the higher cost of low-carbon manufacturing to the end consumer. We cannot raise our prices to incorporate the cost of low-carbon manufacturing because we compete internationally on price. In the long term, a way to pass on that cost is needed.

Graham Simpson: I am sorry to step in, convener, but I wonder whether the witnesses could shorten their answers, because there are quite a few questions to get through.

The Convener: If the witnesses think that they have not been able to give a full answer, or if they want to give some thoughts that they were not able to provide spontaneously, please submit further comments in writing to the committee, following the meeting.

Dr Casey: I support Rich Woolley's point. Industrial prices in the UK are some of the highest in the world. The cement plant in Scotland, for example, is owned by a multinational company, as are the majority of UK cement plants. When people consider where to invest, they look for the best return on their investment. Unfortunately, the UK is not necessarily seen as the best place to invest.

I completely agree with Rich Woolley that we do not necessarily want Government handouts, but we do not want to shift our operations overseas. There have been recent news reports of shortages of construction materials, such as roof tiles. If we were to shift all the cement plants overseas and just rely on imports, we would open ourselves up to risk and security of supply issues. We do not want that.

Companies are on board; we want to decarbonise and to meet the ambitions in Scotland. However, we need to ensure that there are investable propositions for international companies.

Professor Haszeldine: I will be brief. I totally agree with the previous comments. It is important to realise that Scotland and the rest of the UK could be out of step with much of the rest of the world. If we are to lead on decarbonisation, how we pay to decarbonise will have to be done differently. That could, of course, have an impact on products.

The UK Government does not yet seem to have succeeded in producing a business and commercial model that does not involve subsidising the first start-ups of the different projects. That is why big companies such as INEOS and Petroineos—there are two different companies at Grangemouth—tend to hang back and wait until the economic and political pieces come together such that they can invest. Otherwise, they will be put on the spot and made scapegoats in Scotland. That is undesirable for them nationally and internationally.

We need things such as carbon border adjustments so that we can ensure that the carbon that is embedded in our imports equates with the carbon that we take out of our manufacturing. That needs to be equalised somehow, and not just for the first project but for the long term.

In addition, I think that, rather than looking at individual projects, we need to have a more strategic view of how we are going to equalise the pain, or the difficulty, of decarbonising across all industries rather than in just one or two very big, energy-intensive industries. I have sent in a short extra submission explaining how different certification obligations and storage of CO_2 obligations could help with that.

10:00

Colin Beattie (Midlothian North and Musselburgh) (SNP): I want to have a look at negative emission technologies. I am very conscious that such technologies have been proven in test facilities, on a small scale, but are not currently available or being implemented anywhere on the scale that is necessary to remove significant volumes of carbon. How realistic is it to expect that negative emission technologies can be planned, developed and made operational so that they can deliver negative emissions by 2029 and a 376 per cent reduction in emissions by 2032?

Professor Haszeldine: I agree that negative emission technologies appear to be emergent and not yet fully commercial, but I think that it is also important to realise that there are multiple ways of undertaking negative emissions. Those include the recapture of carbon dioxide using trees—[*Inaudible*.]—and short-term operations, such as the recapture of carbon dioxide by crushing up rocks and minerals to accelerate the natural weathering of rock material, which absorbs CO_2.

At the end of the day, one way of undertaking negative emissions involves the building of large air capture machinery operations, which already exist in British Columbia and in Switzerland. Two companies worldwide have such types of equipment and are in the process of scaling them up to be not just test facilities but facilities that can handle 1 million tonnes a year. If we wanted, we could accept an investment proposition from Carbon Engineering to build a CO_2 air capture plant in Scotland. That technology is proven and is operating; it could probably be operational within two or three years. That is entirely realistic.

Of course, the problem then is about who pays for that, which raises the type of conversation that we have just had in relation to the energy-intensive industries. That payment for direct air capture, either as a public good or as an industrial facility, needs to be much more inventively created as a business system by either Scotland or the Westminster Government.

The second type of facility of that sort is run by a company called Climeworks, from Switzerland. It has had an experimental site in Iceland running for about two years, and is now in the process of adding multiple extra units to that, to try to capture and dispose of 400,000 tonnes of CO_2 a year in about two years' time. It expects international purchases of that CO_2 offset. Companies anywhere in the world could purchase a tonne of CO_2 to be captured and then stored safely and securely underground. We could be looking at having the same sort of industry in Scotland. If we built and operated our CO_2 transport and storage pipes out of St Fergus in the north-east, that would be an ideal place to add on those extra types of industrial carbon capture from air.

Colin Beattie: We are working to some tight delivery times. We are talking about 2029 for delivery, and a challenging 376 per cent reduction in emissions by 2032. That is not very long. Is it realistic?

Professor Haszeldine: As I mentioned, I think that that intermediate milestone is really important, because it challenges people to get on with things. However, I think that it is going to be very difficult to meet that intermediate target in Scotland, because doing so relies on producing multiple different builds simultaneously of $C0_2$ capture facilities and pipeline to the storage site. That relies on UK investment over which we have no direct control, although we do have extremely valuable political support from the Scottish Government, which is essential.

Secondly, we need to decarbonise the methane gas heating system. One way of doing that is to produce hydrogen. However, building enough facilities to produce enough hydrogen by that time will be difficult. We also have the problem that we cannot yet distribute that hydrogen through the gas grid, because the legislation does not yet allow large amounts of hydrogen into the gas grid. It is therefore still not legitimate for companies to do that.

Thirdly, we also need to develop a much bigger ambition on air capture to balance the residual emissions from a facility such as a cement works or Grangemouth chemicals plant, where it may be economic to capture up to 80 per cent of emissions, but where capturing the final 20 per cent will be much more expensive. That is where the air capture proposition comes in. We need to have that operating as soon as we can. Again, that is an aspect of trying to be a leading country. Getting down to net zero by 2045 will require innovation, so we have to not be afraid of going first, and this is one of the places where we need to go first.

Dr Casey: Mineral products are brilliant for negative emission technologies, because they are constantly taking CO_2 out of the atmosphere, throughout and at the end of their lives. For example, a number of academic studies have shown that, throughout its life, concrete will remove from the atmosphere about 23 per cent of the process emissions that were produced when it was made. A slight easy win here would be for those emissions that are removed from the atmosphere to be included in Scottish inventories; at the moment, they are not. We have been working with Government on that—particularly in England, I have to admit; we should speak more to Scottish officials as well. Although it is really important greenhouse gas removal, it is not—as I said—included in inventories at the moment. Across the UK, we could be looking at around 1 million tonnes of CO_2 captured. I realise that that is not quite the scale that you are looking for, but every little helps. That is already happening, but we are not accounting for it.

Colin Beattie: Is there not a risk in relying on this technology? It is supposed to remove 24 per cent of gross emissions by 2032, which we have already heard is a challenging target. Should we have a contingency plan, and what would that be?

Dr Casey: In our sector, a contingency plan might be more use of biomass with carbon capture. Professor Haszeldine also mentioned planting trees. We feel that using biomass fuels should be in relation only to plants that will—when it is available—be using CCUS. At the moment, lots of Government incentives are sending biomass to numerous smaller consumers through things such as biomass boilers and anaerobic digesters.

In the cement sector, we have noticed that our use of biomass fuels has declined, because we are not able to access some of the incentives that are diverting the biomass elsewhere. The problem is that we are going to need carbon capture in the cement sector, and it is absolutely vital to combine that with biomass fuels to maximise their benefit. We would like to see some of those incentives changed to make sure that those consumers that will be able to use them with carbon capture in future can access them now. At the moment, we are not able to compete on a level playing field, as the biomass is being diverted to consumers where it is not best value for money and is not making the most of the fact that we could also be capturing those emissions and removing more out of the atmosphere than is being produced.

Professor Haszeldine: Colin Beattie's question was about how we can be sure that we will be able to do this by 2032. As I have said, although it will be difficult to meet the overall target, one way of trying to spread the risk is to invest in multiple different types of negative emissions. Planting trees is one thing, but they will take time to grow.

In some of the Scottish Government's accounting, we count our trees as negative emissions. However, they are not actually negative emissions; they are only standing trees.

One way to get the best benefits is to create biomass fuel industries in Scotland, on an industrial scale, where we can capture CO_2. For example, individual river catchments that transport biomass from forestry for up to 30km or so could feed into disperse biomass plants that could capture the carbon dioxide from that biomass and put it back underground. That is a negative emission.

Other aspects of negative emissions have not really been focused on in Scotland, yet. Numerous small biomass plants in the central belt do not capture any of their CO_2. Energy from waste does not capture its CO_2—although a lot of that is biological—and there are quite a lot of fermentation emissions from making beer and whisky. We emit more than 500,000 tonnes of pure carbon dioxide every year, which we could capture and put underground as a negative emission.

Another aspect is mineral products. I totally agree with the points on cement recarbonisation. That is an uncounted benefit of cement, which we should count. However, we could also devise ways of using previous slag waste material from places that were formerly steelworks, or we could use waste from road stone quarries, crushing that rock in order to allow it absorb CO_2 more efficiently. Last of all, we could use engineered large-scale machinery.

With that package of approaches, we could have negative emissions of maybe 5 million tonnes per year from forestry— out of 7 million tonnes a year of captured wood—3.5 million tonnes a year from recapturing the biomass that we already combust or let go as pure CO_2, an extra 2 million or 3 million tonnes a year—quite straightforwardly—from engineered-machinery carbon capture, and probably another 500,000 or 1 million tonnes per year from turning forestry into charcoal and biochar and putting that back into the ground as recarbonising soil.

Multiple different actions could add up to about 10 million tonnes. I am concerned about getting the arithmetic approximately right. As many people have stated, there are many small and medium contributions, but they all need to add up into a big contribution. I am unsure that, in Scotland, we have made the arithmetic work for us yet.

Richard Lyle (Uddingston and Bellshill) (SNP): My first question is for Rich Woolley. Although Scotland has significant advantage in engineering expertise and geological storage, there is also competition from Teeside and Humberside. How can Scotland capture the economic and carbon sequestration benefits?

Rich Woolley: That goes back to the points that I have already made. The economics need to stack up for investment. Therefore, developing a business case for people to invest in those carbon capture and storage infrastructures and capture plants is the way to go.

That includes providing capex funding and on-going support for the higher operational cost of capturing and compressing carbon at the end of the chimney and paying for it to be transmitted and stored in the North Sea.

If Scotland can come up with an investable business model, industry will go for it. The future is low carbon and, if you are a fast mover, there are advantages to be had. However, at the moment there are not, because there is no business case for investing.

10:15

Richard Lyle: You have anticipated my next question, which is also for Professor Haszeldine.

What scale of investment is required to deliver a viable carbon capture and storage or negative emissions technology industry in Scotland? How should those costs be borne? What should the balance between public and private sector investment be? Earlier, it was suggested that investment should not be made entirely by Government. What can industry do to invest in that technology?

Rich Woolley: When we talk about carbon capture and storage, it is easy to think of it as one uniform technology, such as wind turbines or solar panels, but it is actually made up of unique bespoke solutions for every industrial site, which makes it incredibly difficult to talk about how much it will cost. It will be very difficult to achieve the economies of scale that we saw with renewable technologies, for example. Some sites will have clean, pure carbon dioxide process emissions. In those cases, it will just be a matter of compressing those and sending them off to be stored. Other sites, however, will have multiple, very low-grade CO_2 streams coming out of a site that is 2km across. The costs vary significantly across the sites, and so do the solutions.

I cannot speak to the issue of who should bear the costs. However, as Dr Casey, Professor Haszeldine and I have said before, there needs to be a business case for investment and, at the moment, it does not stack up for energy-intensive industries, because they compete in an international market. Basically, they would have to absorb the higher cost of low-carbon manufacturing. There is no ability to pass that cost

through to the consumer, and that means that either they cannot compete or they are less competitive.

Karen Turner's team at the centre for energy policy at the University of Strathclyde is doing interesting work in that area, looking at the benefits of investment in CCUS across the Scottish economy. She was also on the just transition commission, so she has a role in that area, too. I recommend contacting her if you would like some further detail.

Professor Haszeldine: There are two or three different aspects to the answer; I will come to the carbon capture and storage bit last.

First, it is clear that the world is heading towards decarbonising, so we had better be part of that or we will be left behind. We are trying to be in a lead position, so we have to invent the business case for decarbonising. Part of the business case is wealth creation from maintaining high-value jobs in the chemical and manufacturing industries—as well as the offshore industry, because we should not forget that many jobs in the North Sea and offshore industries elsewhere are disappearing. For example, BP has laid off 10,000 people globally over the past two months, because it is changing into a lower-carbon company.

We need to be aware that, if we want to have any expertise in industry in Scotland, it needs to be on low carbon and we have to be in the lead on that. What we invest in it will be more than paid back by maintaining existing jobs and creating new low-carbon jobs. In 2019, Vivid Economics wrote a report for the Department for Business, Energy and Industrial Strategy that showed that carbon capture and storage is by a very long way the best technology for the UK to invest in to gain that added value, because it affects many areas of industry and employment and enables the just transition out of oil and gas and into the lower-carbon economy.

Secondly, I agree that carbon capture and storage can be split into four different areas. There is power and electricity; hydrogen generation, with blue hydrogen, or decarbonised methane; industry emissions, which we have spoken a lot about in this meeting; and negative emissions, which we have spoken about as well. Without carbon capture and storage, we cannot do any of those things, so it is essential that we make it work.

With regard to the business model, I suspect that the UK has reached initially for an electricity model for production, with which it is comfortable. That will help the Teesside project, for example, to build a gas-fuelled power plant with carbon capture and storage, but it will not help in respect of industrial emissions, unless there is a fuel switch to clean electricity.

In Scotland, however, a lot of industrial companies are interested in participating in decarbonisation. We need to find a different way not of subsidising CO_2 capture, transport and storage, but of spreading the load of that. We have spoken about a single industry—such as Grangemouth, or a cement works or paper mill—having to capture all its carbon dioxide. An alternative way forward would be to place a mandate on the oil and coal companies that provide the fuel to say that they should be responsible for disposing of the CO_2.

A CO_2 transport and storage facility that is similar to what we are speaking about—it is called the Acorn project—has been set up at St Fergus in Scotland. The transport and storage industry sells its CO_2 disposal service—it brings in CO_2 from industries that are partly or wholly capturing it from air, and charges for that via certificates. Industries all over Scotland buy a certificate in order to decarbonise, first by 1 per cent a year, and then by 5 per cent, 20 per cent and so on. The carbon take-back obligation is an entirely different way of spreading the load across industries, and Scotland could look at that. I submitted to the committee some evidence that briefly explains the concept; members can look at it later—it is probably sitting with the clerk.

That is a way of innovatively creating a business that—as the other witnesses both said—enables industry to participate without relying on Government subsidy. It is essential that we get away from Government subsidy, because it is difficult to bank on that into the far future, as nobody knows what the Government will do next year or the year after. Creating a sustainable carbon take-back obligation is the way forward.

Richard Lyle: The official statistics on "Scotland's Carbon Footprint: 1998-2017" that the chief statistician published this morning show that, during that period, Scotland's carbon footprint fell by 21.1 per cent, with an overall reduction of 30 per cent between 2007 and 2017. I am sure that you will look into that very soon. I thank you for your answers.

The Convener: Professor Haszeldine, you said that it is essential to get away from Government subsidy. Is that possible? What would be the timescale?

Once you have given your thoughts on that, we will move on to questions from Gordon MacDonald.

Professor Haszeldine: That would rely on the business innovation that I just described, which we would refer to as a carbon take-back obligation. It is an academic proposition that has received strong interest from several oil companies, but they need Government backing to be able to enact

it. We tried to put it into the bill that became the Energy Act 2016 as it went through the Westminster Parliament, and we are concerned with publicising and working with the concept just now. The Netherlands, for example, is looking at a very similar style of obligation to spread the load of CO_2 capture, transport and storage across the whole economy, not just one or two industries.

The obligation would make importers or producers of fossil carbons—oil and gas, and coal, if necessary—responsible for disposing of 1 per cent at first, and then 3 per cent, or whatever, a few years later. By 2030, we would make that figure 10 per cent, so we would automatically achieve our objective by that point, and we would set a clear objective for 100 per cent of CO_2 storage by 2045 in Scotland and 2050 across the UK as a whole.

It is up to the oil company operators to discharge their obligation by acquiring CO_2 from capture sites, air capture, mineralisation or any of the different types of verifiable CO_2 capture that we have discussed. Once those operators can demonstrate storage, their storage certification cancels the obligation that they have brought with them. That is a way of transferring the pain across the whole economy.

We calculated, for example, that to undertake 10 per cent of capture of CO_2 by 2030 would put the price of a litre of petrol up by just a few pence—4p or 5p a litre—because of the tax buffer. That is a way of spreading the minimal cost, and it could be set up extremely quickly.

The Government could also say that fossil fuel producers need to take liability for what are technically known as scope 3 emissions—the emissions of their products. Most European oil companies, such as BP, Shell, Equinor, Total and Repsol have already stated that they want to do that, but they need help through Government action. The actual bureaucracy involved in that is minimal, because we know where all the oil, gas and coal are derived from, and it is a simple matter to place the obligation certificate on those tonnes of carbon and then to wait for its discharge through guaranteed storage certificates being provided by the oil company operators.

That is also a way of transferring oil companies from oil production to carbon disposal as part of the just transition. However, that is a rather more radical thought than Westminster and BEIS have been able to cope with. I think that Scotland could consider that and introduce it regionally.

The Convener: Thank you for that explanation.

Gordon MacDonald (Edinburgh Pentlands) (SNP): The update to the climate change plan highlights a number of funds. There is the emerging energy technologies fund of £180 million; there is the Scottish industrial energy transformation fund of £34 million; there is the low-carbon manufacturing challenge fund of £26 million; and there is the green jobs fund of £100 million—making a total of £340 million. Is that sum adequate to secure the necessary investment?

I also seek some clarification. Dr Casey, you asked for support for on-going operating costs. Would that be on a match-funding basis? What basis would that be on if there was to be additional support? Are the other funds adequate for the purposes for which they have been set up?

Dr Casey: That £340 million sounds like a lot of money, and it is. If we considered putting a carbon capture plant on a cement plant, that would probably swallow up most of that money in one go, and that would be the capex cost without the on-going operational cost.

Returning to my earlier point about support for on-going operational costs, I mentioned electricity prices being extremely high, and part of the problem from the point of view of an energy-intensive industry is that domestic electricity prices are capped, and that means that, as soon as there is an increase in cost, it gets loaded on to industry. Other countries can—or choose—to spread some of those costs across all their consumers to protect their energy-intensive industries, recognising that the industries provide jobs, which allow people to pay their bills and not end up in fuel poverty. In the UK we do not do that, however.

When I talk about support for on-going costs, I am not necessarily asking for grants to be given to us. We are looking to reassess how some of the cost distribution happens already and whether some of that cost can be taken off.

Electricity is a massive concern. In its sixth carbon budget, the Climate Change Committee pointed out that it is likely that the capacity of the electricity grid will have to be doubled or even tripled as sectors decarbonise and we use more electric vehicles. We are reaching the boundaries of what is technically possible. That will all cost a lot of money. On top of that, as you are aware, wider use of intermittent generation and of more dispersed generation in Scotland means that networks need a lot of balancing. That also incurs a cost.

10:30

We expect electricity prices to keep rising. There has been a 205 per cent increase since 2000. Gas prices will go in a similar direction. The green gas levy opens the door for other levies to be added. Regarding climate change and decarbonisation, we are a little concerned that some industries, such as asphalt, for example, are quite reliant on gas. Those industries do not have

other options because we do not yet have widespread production and distribution of hydrogen. We are loading costs on to our industries, but they have no other options.

We would like to see a redistribution of some of the on-going energy costs. That would protect those industries and make them more competitive.

Gordon MacDonald: You mentioned electricity prices. The committee has previously been told that one aim of using contracts for difference is to deliver some of the cheapest electricity in Europe. You seem to be saying that the opposite is true. Is that the case?

Dr Casey: We looked in depth at the electricity prices paid by industrial consumers between 2000 and 2018 or 2019—I cannot quite remember—and it increased rapidly, by 205 per cent. That is UK data and it is freely available.

We are not seeing cheap electricity at the moment. There are network costs. Charging reforms for transmission and distribution are under way and we expect significant increases to come from those. The CFD element is one part of electricity pricing but, on top of that, there are extra costs such as policy and network costs. Those costs are raising prices and making them uncompetitive internationally.

Gordon MacDonald: Mr Woolley, do you have anything to say about whether the funds that I referred to are adequate to meet our intentions?

Rich Woolley: I agree with everything that Diana Casey has said. Energy costs are critical for us. Anything that can be done to reduce them will help us to level the playing field internationally, and will allow us to compete better to attract investment, including investment in decarbonisation. The energy price is fundamental.

You asked about the funds. We welcome the significant new commitments within the plan. There is a lot in there and it is being directed to the right places.

Government funding is often distributed in small pots and it is difficult for companies that do not have significant resources and time to figure out how to apply for each fund and to prepare their applications. Decarbonisation projects for energy-intensive industries are also so large that companies have to apply for multiple pots of money to make their projects viable. There may be different timeframes for those funding pots. It is incredibly difficult to link up the funds to finance significant, large-scale decarbonisation projects.

We were pleased with the recent announcement of a potential green investment bank at the UK level. Energy-intensive industries need of significant funding like that to get their large-scale decarbonisation projects off the ground. The funds are going in the right direction and are welcome.

Gordon MacDonald: Professor Haszeldine, you have welcomed the various funding streams but you said that clearer proposals are needed on what the emerging energy technologies fund should be used for. What do you think it should be used for?

Professor Haszeldine: Such funds are very welcome. They cover a wide spread of action, which is what we need to do in Scotland. I see them as acting to demonstrate and prove initial studies, or perhaps even small-scale demonstrations, of those types of energy decarbonisation in operation. The funds will not build the whole big project but they will de-risk the application for that project, so I see them as being useful in that sector.

The fund that we are talking about could produce activity in small-scale carbon capture operations at distilleries that are fuel switching to hydrogen, for example, or small-scale carbon capture and transport operations to work out how smaller biomass plants could contribute to carbon capture by using local fuel sources. We should not emulate England by importing huge amounts of biomass, but try to use our own biomass more sensibly.

I see those funds being used to produce smaller-scale projects of £1 million to £5 million each and make them ready to apply for low-risk investment from organisations such as the green investment bank.

Gordon MacDonald: You highlighted that the Scottish Government has tried to remove any doubt about the provision of carbon capture and storage. How important is certainty? You said that it is not all in the gift of the Scottish Government because the UK Government is responsible for some aspects. Given that previous CCS competitions at Peterhead and north Yorkshire were in 2015, how concerned are you about whether we can deliver on CCS without the support of the UK Government?

Professor Haszeldine: We have to hope that the UK Government will carry on supporting it. Producing the pipeline for CO_2 to storage from St Fergus is critical to all the ambitions that we have talked about in Scotland. The certainty that the Scottish Government has provided is extremely valuable; probably more valuable than the finance that it has been able to put into that development so far.

The full-scale CO_2 transport and storage project is presently starting its front-end engineering and design—FEED—analysis, which is the final costing for the engineering designs, so that is likely to be ready to be built and start operating in

late 2024 or early 2025. The money for building it will be a combination of UK Government money—many tens, or possibly hundreds, of millions of pounds through the industry strategy challenge fund—plus funding raised by the company from bank loans and investors, such as Macquarie. That project will be built using not Scottish Government money, but UK and private equity money.

We can provide certainty, but we cannot guarantee a win because many other areas of the UK such as Teesside, Humberside, Merseyside and south Wales, are trying to compete for the same amount of money.

If, as seems to be correct, Scotland is several years ahead of the other UK regions, we in Scotland should capture that first project. If we do not, we will have to look at negotiating terms to send any CO_2 south into England, either via shipping or a pipeline, to be disposed of using the Teesside or Humberside projects. That would entail a delay of several years, and we will undoubtedly miss our CO_2 targets at that point.

Gordon MacDonald: Thanks for the clarification. Dr Casey and Mr Woolley, do you have anything to add on what the focus of the emerging energy technologies fund should be?

Dr Casey: Hydrogen is getting a lot of attention, with a research focus into its potential future use as a low-carbon fuel. Hydrogen also has an advantage in that it could partly or fully replace natural gas in the gas grid. The problem with hydrogen at the industrial scale is that it is quite different, as a fuel, to natural gas, so it is not a direct replacement. For our industry, and for asphalt plants in particular, it would be great if the fund could be used to try to demonstrate the use of hydrogen in asphalt to establish what changes might be needed to the plant before hydrogen is deployed in a natural gas grid.

In the cement industry, we have started looking into plasma energy as a way of electrifying high-temperature processes, which is interesting. We are doing a demonstration project that aims to use plasma to replace about 10 per cent of the thermal demand in a kiln. That might present more opportunities across more industries. It could be a good emerging technology, and a fund such as that one could be really useful.

Rich Woolley: Our low-heat processes could be electrified, but the key barrier to that is the cost of electricity, which Diana Casey has spoken about. We welcome the emphasis in the plan on money for carbon capture, utilisation and storage and for hydrogen. For us, hydrogen is not just a fuel but a potential raw material to replace what we get from fossil fuels, such as methane and oil. Therefore, hydrogen could play a key role in decarbonising chemicals and in making their use circular.

The Convener: Finally, I will bring in Maurice Golden.

Maurice Golden (West Scotland) (Con): Professor Haszeldine mentioned the use of biomass. What are your thoughts on the conflict between burning wood for biomass and the use of wood by the wood panel sector? UK-wide, that sector contributes almost £850 million of gross value added and supports 7,500 jobs, and three of the six UK sites are in Scotland, yet 25 per cent of the UK annual basket of wood is used as fuel rather than in manufacturing.

Professor Haszeldine: I welcome the use of wood in construction. That is helpful and sensible, because it is a versatile material that stores carbon for years or even decades. Therefore, I have no objection to that. However, there is an issue with the final fate of that wood. I see wood as a store of carbon that has been captured from air: CO_2 from the air has gone into the tree and has been captured as wood. Ultimately, we want to put that carbon back underground as part of our carbon storage and rebalancing of the natural environment.

You mentioned using wood as fuel. If we do that, we should enforce carbon capture on all biomass burners, wood burners or waste burners, because we are losing the benefit of the trapping of atmospheric carbon if we let that back into the atmosphere. In addition, capturing CO_2 from wood burning cleans the emissions, resulting in cleaner air.

10:45

If we use wood in construction, I would wish to see a system whereby we recover the waste wood and reuse it to store the carbon back in a building, or, if we are not going to reuse it, it should go into an energy-from-waste system that captures the CO_2. It is a question of whether we capture the CO_2 early, after the tree has finished growing, or after several decades, when the usefulness of the wood for construction has ceased. Does that answer your question?

Maurice Golden: That is excellent, Professor Haszeldine. I have a question on a slightly different topic for you, which I will then open up to the other witnesses. How critical is it for the success of carbon capture and storage that we attempt to cluster sectors and industrial producers? Do we need to have an industrial road map that links our industries so that we can use, for example, waste heat and carbon capture and storage?

Professor Haszeldine: Yes, it is important that we work that out a lot more, because in Scotland we do not have a clear industrial road map for the circularity of our heat or carbon and for putting that back where it came from. In contrast, the Westminster Government has a slightly better vision on that.

The other distinction that I draw is that, when I talk about clustering, I am thinking of clusters such as those present at industrial sites in the north-east of Scotland, around Grangemouth and the central Scotland area and on the east coast all the way up towards Aberdeen. Those are big industrial clusters that could generate the big carbon capture and transport projects that would deal with millions of tonnes a year of CO_2 transport and storage.

We also need to work out how to disseminate the carbon capture throughout Scotland a bit more, because there are many millions of tonnes that we could capture, as I said earlier in my evidence, from biomass, which we are burning at dispersed sites, and from fermentation, from which we are generating pure CO_2 at dispersed sites. Therefore, we need to think about a gathering system of local capture, which the £180 million investment fund could go into demonstrating.

After local capture, perhaps that could be trucked to a railhead, with railway wagons taking the CO_2 to its ultimate industrial disposal site where it feeds into a pipe network through which it would be safely and securely disposed of in the reservoirs deep beneath the North Sea. We need to invent that gathering process across the whole of Scotland.

Maurice Golden: Thank you for that comprehensive answer, Professor Haszeldine. I ask Rich Woolley to respond, and Dr Casey thereafter.

Rich Woolley: Our sector lends itself naturally to clustering. We are present in clusters where oil and gas is traditionally—[*Inaudible*.]—the North Sea and then we turn it into other products. Our sites are highly integrated; base chemicals are produced at the refinery and then the products from that move to downstream sites and so on.

Our sector is very much clustered and integrated. Clustering is a really important part of decarbonisation. It allows us to get those economies of scale rolling out for some of those nascent technologies. Hydrogen and CCS technologies can be proved on large-scale cluster decarbonisation projects in which you can get economies of scale because large numbers of industrial sites and high-heat sources are located next to one another. We recognise that, in the end, we will need to start rolling out those technologies to more distributed and remote sites. I guess that Diana Casey will have more to say on that.

Maurice Golden: Perhaps Dr Casey could address not only the question about clusters, but an additional three questions on the cement industry. First, what heat mapping work, potentially using waste heat, has been done at Dunbar in particular? Secondly, what work has been done on resource efficiency in terms of reducing waste water and energy? Finally, is there any work on the use of different feedstocks—waste products, for example—in the cement production process?

I am sorry to hit you with three additional questions—over to you, Dr Casey.

Dr Casey: That is fine—I shall do my best.

On the point about clusters, Rich Woolley is completely right. The cement industry is, unfortunately, not well placed near clusters. Some plants are—for example, the Dunbar plant is about 50 miles from Grangemouth, which would be its nearest cluster. It is partly down to geology. The sites are located close to raw materials and limestone, as we cannot really trek millions of tonnes of limestone around the country.

As I mentioned earlier, the key points for us are how we link into the CO_2 infrastructure and the hydrogen distribution network, and how we ensure that those dispersed sites are thought about early on and not left as an afterthought. It is important that there is a plan for that infrastructure.

On your specific questions about cement, there is not a huge amount of waste heat from cement manufacture, partly because what would be classed as waste heat is recycled into the process to pre-dry raw materials, so we end up using less fuel to heat them. What is left tends to be very low grade. I know that a lot of manufacturers—and, I assume, Tarmac as well—across the UK have looked into opportunities to use that low-grade waste heat. There are technologies, such as organic Rankine cycle technologies, that can be used to convert that heat into electricity, but the payback time is so long that it is not yet investable. However, there are possibilities available. The problem with the plants being situated in quite rural locations is that they are not close enough to heat networks for the waste heat to be useful, so that is another challenge.

On resource efficiency, there has been quite a lot of work on waste, for example. Zero process waste is sent to landfill from cement manufacture across the whole UK, including Scotland. Any dust that is left over is recycled back into the process; it can also be recovered and used for land spreading, as it is a very good fertiliser. We do not have any process waste at all—we have done well in that regard.

We do not really use water in cement manufacture. The concrete industry uses water; I admit that I will have to defer to colleagues on how we are doing on saving water in that sector. Energy is a big one for us. To go back to the earlier point on biomass, there is a perception—it is not a misconception, because it is true—that biomass is just about wood, but it is not. In the cement industry, we use a wide range of part-biomass and 100 per cent biomass fuels. That covers things such as tyres, because the rubber content is biomass, and meat and bone meal from abattoirs. We also use sewage sludge. We use a tiny bit of wood, but it has already gone through a first use—it might be waste wood from the construction or demolition industry, for example. The sector uses a range of biomasses.

On your final question about feedstocks, our road map includes a section on low-carbon cements. The cement industry currently uses a number of additions, as we say, which are cementitious materials to replace the clinker content. Clinker is the high-carbon component of cement. That includes waste such as ground granulated blast furnace slag from steel production and pulverised fly ash from coal-fired power stations.

The big issue with those two is that blast furnaces are in decline and coal-fired power is definitely on the way out, so that leaves a bit of a gap. The MPA is running a project that is looking at reducing the use of those materials and increasing the use of limestone. There is some limestone waste—limestone is abundant in the UK, and it is our main raw material for cement. We can combine that with the slag or the ash in order to use less of those materials, and thereby produce cements that are of considerably lower carbon than what we currently have, but which are still of the same formulation so that the construction industry will be happy to use them.

For construction, we need to use materials that meet the correct policies and standards to make our buildings safe, and those low-carbon cements are an option in that regard. We are running a project to look at that as another way to help fulfil our decarbonisation ambitions.

The Convener: I do not wish to interrupt, but we are running short of time. If any of our witnesses want to add to what they have said, in particular on the final points that Dr Casey made in response to Maurice Golden's questions, they should do so in writing. The committee may also send out further questions for comment.

I thank all our witnesses for joining us today.

10:56

Meeting suspended.

11:01

On resuming—

The Convener: I welcome our next three witnesses on the climate change plan: Cat Hay, head of policy with the Food and Drink Federation Scotland; Richard Simon, senior consultant with Element Energy; and Clare Reid, director of policy and public affairs with the Scottish Council for Development and Industry.

The sound team will bring you in when you want to speak. It would be helpful if you could type R in the chat box when you want to contribute to a particular question or point. You might not be able to say everything that you would have liked to, so feel free to write to the committee if you want to add to what you have said or to add an explanation to your answers.

The first questions are from Gordon MacDonald.

Gordon MacDonald: I want to set the scene a little. What has happened over the past three years that explains why, in the updated climate change plan, the Scottish Government is more optimistic and ambitious in its expectations for carbon emission reductions by 2032?

Richard Simon (Element Energy): Through our work on industrial decarbonisation, we noticed that, when there was an 80 per cent reduction target—before the net zero target was set—it was assumed that industry would account for some of the remaining 20 per cent of emissions and that it was a hard-to-abate sector. As we have carried out more investigation and work, we have found that the CCC does not call industry a hard-to-abate sector anymore—that terminology has disappeared.

On an industrial scale, some of the technologies will cost industry a lot of money, so support will be necessary to keep industry in the country. However, compared with some of the domestic and commercial costs, such as those for heating, industry is no longer considered to be one of the hardest sectors to abate, although some emissions, such as process emissions, remain hard to abate. Therefore, a greater level of ambition within industry is appropriate. The greatest change from the UK's fifth carbon budget pathway to the sixth carbon budget is the greater levels of emission reductions that are possible in manufacturing and construction.

Gordon MacDonald: You have said that there can be greater reductions in emissions from industry. Do you have an opinion on the recent planning application for the UK's largest underground coal mine for 30 years, at

Whitehaven in Cumbria? Will that have an impact on the UK's commitment to reduce carbon emissions to net zero by 2050?

Richard Simon: It will have an impact. Greenhouse gas emissions from closed coal mines—methane that leaks out and so on—are some of the hardest to abate, so there will be an on-going impact from fugitive emissions. The coal mining operation will produce fuel and, as has been talked about, the scope 3 emissions from the products that are produced will be significant.

Coal is still used in the iron and steel industry at the moment, but it is hoped that it will be phased out and that electrification and hydrogen technology might be possible. There is also carbon capture technology for the use of coal in the iron and steel industry. It is possible that, in future, iron and steel production will be combined with carbon capture so that the emissions impact is lessened.

Gordon MacDonald: I do not know whether you heard the session with the previous witnesses, but we talked about carbon capture and storage. The UK Government pulled the plug on carbon capture and storage back in 2015. This time round, is there the same level of commitment, or more commitment, to deliver on carbon capture and storage? We should bear in mind that not everything in that regard is in the Scottish Government's gift.

Richard Simon: There is now more and better-focused commitment. The cancellation of previous projects has definitely affected the industry's confidence in the Government's appetite for carbon capture and storage. The difference this time is that renewables costs for electricity production have come down hugely, and there has been a shift in focus for carbon capture and storage. Previously, the focus was on power and fossil fuel use with carbon capture and storage, and the renewables element was not seen as attractive. The evolving dynamics of renewables getting cheaper probably caused, at least partially, some of the cancellations.

The focus is now more on industrial carbon capture relating to process emissions from the cement industry, which we have talked about, emissions from fuels that are generated internally in the chemicals industry and high-temperature industrial heat. There is a change in focus. Carbon capture is slightly better suited to those areas than it was to power, and I do not see a huge competitor in those areas. There are expanded applications for that at smaller sites, although electrification and hydrogen are more competitive there, so there is less of a sure need in that respect.

Clare Reid (Scottish Council for Development and Industry): I will comment on Gordon MacDonald's first question, which was about what has changed. We did not look at that issue in our report, but we received feedback from our engagement with businesses. We spent about a year pulling together our report and engaging with 16 partners and the SCDI's wider membership.

There has undoubtedly been a shift in the commitment of businesses to net zero carbon goals. My previous role was in the built environment. Three years ago, large built environment organisations, house builders and construction companies set timescales to meet their commitments within a few years. That is now happening at a pace that we have not seen before. The Scotch whisky sector, salmon producers and the oil and gas sector have been proactive in producing plans setting out how they want to make change and achieve their objectives. That is my perspective on what might have changed in the past three years.

Cat Hay (Food and Drink Federation Scotland): I will add to what Clare Reid said. The other thing that has fundamentally changed quickly are the shoppers and consumers, who are demanding and looking for products that are environmentally sustainable. They are looking at not just the waste, packaging or ingredients but the entire method of production for products. They are looking for that level of transparency and for something that is truly environmentally sustainable.

Gordon MacDonald: Does any of the witnesses have examples of decarbonisation technologies that are being adopted in an energy intensive industry?

Richard Simon: Lots of those technologies are still under development, but they are getting there. Hydrogen has become much more of a thing in the past couple of years, and it is currently being demonstrated in energy intensive industries in the north-west of England and internationally. I emphasise that it is already being used as fuel in the chemicals industry, where it is made as a by-product, so there is a backlog of evidence there.

I emphasise that international evidence can be brought in. Sites are specific, but I will use the example of INEOS, as it is one of the largest manufacturers in Scotland. It is an international organisation that is perfectly happy to bring in evidence on things such as hydrogen from elsewhere in the UK or from international manufacturing for use here.

Electrification has been going on for a long time, so it is less of a new thing. Lots of the technologies for electric steam boilers and the like

are already commercially available. The issue in the UK is that the price of electricity compared to that of gas means that they are not being taken up. In other countries, where there is not such a good gas network and less of a gas history, those technologies are being taken up and are more economically feasible.

In low-temperature applications, electrification technologies are already available and can be installed in the next three years if there is support, but that support is the big question. Other technologies such as heat pumps and carbon capture and storage are being demonstrated and pulled through.

There is lots of progress. In some of our work and our timelines, we have been quite conservative in the amount of progress and technology development, but it is looking hopeful that those technologies can come through sooner than that.

Gordon MacDonald: Thank you. I am sure that my colleagues will expand on some of the details of that.

Graham Simpson: The choices that we make as individuals can have an effect on the planet and the environment. I am thinking particularly about the food and drink that we consume, so I suppose that this is a question for Cat Hay. Recently, I was watching a programme where people were served a three-course meal and asked to guess which dishes had the greatest impact on the environment with regard to their carbon footprint. It was fascinating. The meat and dairy industry can have quite an impact and some vegetables have to be flown rather than shipped into Britain. Can you say what your industry is doing generally to reduce its carbon footprint? From a consumer point of view, should we have a traffic light system on packaging so that we can be assisted in making sensible choices?

Cat Hay: The food and drink sector is doing a number of things. A huge amount of work is going on in the area, whether it is on carbon emissions or water. The FDF represents the manufacturing sector, but I can speak more broadly for the food and drink supply chain. In relation to sustainable methods of food production in the agriculture sector, a number of schemes are under way to look at carbon sequestration and sustainable methods of meat production.

In the food and drink manufacturing sector, as I said, we are looking at energy efficiency and reducing packaging, and a huge amount of work is being done on sustainable supply chains and where we source ingredients from, which you referred to. For example, are we flying in products unnecessarily when we could be getting them from closer to home? A huge amount of work is going on in that area.

I am sorry, but what was your second point?

11:15

Graham Simpson: When I buy a packet of asparagus from Morrisons or any other supermarket, that could have been flown in from thousands of miles away. Would a traffic-light system be a good idea, so that people can make sensible and informed choices?

Cat Hay: Again, a lot of work is under way in the food and drink sector on carbon labelling more broadly. Whether traffic lights are the right system remains to be investigated. I am aware that some academic projects in Scotland are considering how we could carbon label products in a way that is clear for the consumer. I think that traffic-light labelling for nutrition has been useful in helping consumers to make healthier choices, so it is definitely worth investigating.

Graham Simpson: That is good. You mentioned packaging, which is certainly something that your organisation covers, given that you deal with manufacturing. A lot of packaging is still neither recyclable nor compostable. What is being done to address that?

Cat Hay: We are a member of the plastics pact, which is a UK initiative that aims to make all plastic packaging in the UK recyclable or compostable by 2025. Many major manufacturers and retailers, and indeed the Scottish Government, are signatories to that.

The situation is changing very quickly. In Scotland, implementation of a ban on single-use plastic items is coming—there was a consultation on that recently. Manufacturers are taking steps to change quickly, whether that means moving from unrecyclable plastics to paper alternatives or looking at compostable alternatives. We acknowledge that more work is still to be done, but the pace of change is accelerating all the time.

Graham Simpson: Do you have any statistics on how much progress is being made?

Cat Hay: Yes. I can write to the committee with those. There are a number of reports to which I can signpost the committee, and I will be very happy to do so.

The Convener: Before we come to the deputy convener's questions, Clare Reid wants to comment.

Clare Reid: Thank you. It is just a small additional point on the question of how we help people to make the right choices. In our research, we are keen to try to think of ways, not just for food and drink but across all aspects of

sustainability, to provide people with a suitable range of affordable alternatives. One thing that we have recommended—again, within the broader green skills agenda—is that all universities, colleges, schools and employers that provide training should refocus on carbon literacy. That plays into Cat Hay's point that we need to help people to understand how to make such choices. However, we also need to give them alternatives. I make that point to highlight that it is crucial that there is a focus on bringing everyone with us and changing hearts and minds.

The Convener: Thank you very much. We now come to questions from the deputy convener, Willie Coffey.

Willie Coffey: Good morning to the panel. It is nice to see you.

I will make a wee jump from our discussion about asparagus to whisky and beer. This is maybe a question for Cat Hay. Did you hear the comments by Professor Haszeldine, who was on the previous panel? He told us that half a million tonnes of CO_2 that come from beer fermentation and whisky distillation every year are not being captured. I was certainly not aware of that. Are you aware of that? What place should the food and drink sector have in the whole project of trying to decarbonise in Scotland? What role should it play?

Cat Hay: Food and drink manufacturers are ready and willing to play their part. The FDF does not represent the distilling sector or the brewing sector, but I know that the Scotch Whisky Association recently published its net zero plan, and I imagine that it addresses that issue in that plan.

More generally, the challenge for our industry is that, although the food and drink manufacturing industry is Scotland's largest manufacturing sector, our businesses are predominantly small and medium-sized enterprises. Therefore, we are talking about lots of small-scale interventions to have an overall impact in Scotland.

Willie Coffey: Professor Haszeldine talked about everybody playing a part and having a role—almost a distributed responsibility—and about things such as a carbon take-back obligation. Do the panel members see merit in everybody recognising that they can make a contribution and that, if they are a polluter, they can contribute by reducing that pollution?

Cat Hay: To add to my earlier point, there is a real economic opportunity for the food and drink sector in Scotland in being as environmentally sustainable as possible. I am absolutely sure that our members will want to play their full part, because there is a clear business opportunity for them in doing so. Scotland wants to have a reputation for producing high-quality products with an excellent provenance, and a huge part of that is proving our environmental credentials. It is not enough just to stick a note on a website somewhere. People really want to see and understand that that it true, so it needs to be clear and transparent.

Clare Reid: I agree that industry fully expects to play its part. The partners that we have worked with have brought forward plans and suggestions for how that might happen.

I will make a couple of points. The previous panel discussed the best way to distribute the effects. We have not looked at that in great detail, although we have suggested that, to support carbon capture and storage, we need some sort of emissions trading system. It was interesting to hear Professor Haszeldine talk about some of the options that are being considered. We have not put forward a specific view on the right way to distribute the responsibility, but the industry is ready to take its share.

A number of complications underlie that. Industries will be going at different speeds, and they require different support. That might be a signal about future housing standards and what that will require by way of investment, or an indication of future hydrogen policy, for example. There has been quite a lot of discussion about that this morning. We certainly support the move towards hydrogen, but those in industry—in the construction sector, for example—require to know the direction of travel and how quickly things will happen to meet their investments. The industry is willing to play its part, but it probably needs to work more closely with Government to understand the pace at which change could happen and what support there is to incentivise change and for research and development of new technologies.

Richard Simon: On the point about biogenic carbon emissions from the fermentation process, I caution that the sites are relatively small sites that are dispersed around the country, and that brings in a cost element. There are not the same economies of scale. It is harder to get the CO_2 from lots of small sites than to get it from one big site, such as a potential terminal at St Fergus or Grangemouth. However, the opportunity is relatively large, so I echo Professor Haszeldine's thoughts. Further investigation and push are needed to check the cost of those potential negative emissions. That is worth—[*Inaudible*.]

On the carbon take-back mechanism and the mechanism for achieving net zero, carbon take-back is one option that focuses on the fossil fuel side and taking back carbon for carbon capture and storage. Its applicability is relatively limited to that option, whereas the other options, which involve switching fuels—for example, to hydrogen,

green hydrogen and electrification—involve different fuels with different supply chains.

We need to ensure that the mechanism for decarbonisation is technology neutral so that we achieve the best outcome for each of the different industrial sectors and sites in Scotland. Different sites will have different demands for heat and electricity and different process requirements, so they might have a different option that is more favourable for them. We need to ensure that the support mechanisms take that into account and achieve the best outcome for Scottish manufacturing.

Carbon border adjustments, which were mentioned earlier, are an important part of that for goods that are traded internationally. At the end of the day, it is important to decide whether the cost is borne through Government and taxation or consumer pricing. The just transition work on that should be focused on.

Willie Coffey: I do not know whether I have time to ask a second question. I will take guidance from the convener.

The Convener: You do, if the question and the answers are sufficiently brief. Please carry on.

Willie Coffey: My other question is about the development of new technologies. If it is impossible to have retrofitting solutions for any of the new technologies that we might deploy, should the Government have a role in encouraging that transition, or should we mandate the decommissioning of fossil fuel appliances if a retrofit option cannot be provided? That query is a bit more technical. Maybe Clare Reid would like to start, followed by Richard Simon.

Clare Reid: Can I clarify something? Are you thinking about retrofitting in households or in industry, or in both?

Willie Coffey: I was thinking about both. I would like your views on what the implications of that might be.

Clare Reid: We have not done a huge amount of work on that, but I suppose that I can comment in a couple of ways.

When we considered the opportunities with hydrogen and carbon capture and storage, we were keen to understand the extent to which the assets—[*Inaudible*.]—reused. This is maybe not what you are asking about, but it is clear that there is an opportunity for thinking about how some of those assets could be repurposed rather than scrapped.

It will depend on each industry. We have argued for helping the agricultural sector to decarbonise and perhaps to move towards lower-carbon—not diesel—vehicles and machinery, for example. However, that takes investment and innovation, and some of that equipment is not at the right level of affordability. There could be a range of incentives. Schemes could encourage people to scrap their products or to invest, and they could take out some of the cost of that investment. The electric vehicle sector, for example, has had low-interest loans. There could be similar schemes and incentives.

On the household side, part of the answer to your question might be that it depends. Quite a lot of the work on the built environment is about finding non-gas solutions for housing, but there might be some hydrogen-based solutions—whether blended hydrogen or pure hydrogen is involved—that could work in future. Whether people should scrap their boilers at the moment depends on what Government policy is and how quickly the hydrogen alternative might be brought forward.

Some of the discussion on the built environment has been about trying to pre-empt those decisions, and ensuring that the assets that are being put into new housing are ready for the change in fuel supply. It is difficult to say what the right solution is for each sector. It is likely to be a combination of scrappage incentives and support to invest in new assets or, in some instances, to repurpose assets.

11:30

Richard Simon: I will not comment on the built environment side, as my expertise does not lie there. We have done some work on the Scottish building stock and the potential of different heating solutions—that was for the Scottish Government, I think.

On the industrial side, we have done work on retrofitting hydrogen solutions and on what would need to change. Lots of the industrial equipment is bespoke for the sites concerned, with large bespoke pieces of equipment, rather than packaged boilers and the like. It is possible to change some of the components and burners to change them over to hydrogen. Obviously, that entails a cost, but it is a relatively lower cost than the cost of changing the whole piece of kit and installing either an electric solution or a new hydrogen solution.

I would caution you that scrappage does not necessarily equal bad. We need to consider the whole picture, including the on-going operational costs and their carbon implications. Although hydrogen might be easier and could mean slightly less disruption, which needs to be taken into account, electrification still needs to be considered. As it is less new and interesting, it does not quite have the same focus as hydrogen.

The Convener: I am conscious of the time. I will ask a few focused questions, addressing one to each of our witnesses individually.

Perhaps Richard Simon could comment on this. We have had a question raised about consumers wanting to be renewables friendly and environmentally friendly, but consumers have limited time in their life to consider those issues in their decisions.

Without naming any specific companies, I can give one example. A consumer who decides to buy electricity from a certain company because it supplies energy from a renewable source might pay a slight premium on that. Once the company has them, so to speak—as sometimes appears to happen—increases are brought in on an on-going basis, so the energy becomes increasingly costly to that customer. Can anything be done in that regard? There are two separate issues here. One is the question of where the energy comes from and the customer wanting to buy it; the other is about making companies continue to price fairly. Can you say something about that?

Richard Simon: On the second part of that question and ensuring that what you spoke about does not happen, such pricing is bad business practice, in a sense, and it needs to be dealt with either through regulation or through incentivising and informing consumers, in order to ensure that they can make informed decisions and to make it easier for them to switch. That mostly concerns the energy supply side.

On the manufacturing side, lots of the products that are bought involve business-to-business transactions. While consumers are increasingly focused on carbon emissions, the bottom line is king as far as businesses are concerned, and they will be seeking the cheapest suppliers of products, unless there is some other incentive—be that local manufacturing or getting publicity.

I would echo the comments made by the first panel of witnesses about private investment and how money can be allocated through the broader carbon agenda. That is key to ensuring that mechanisms are in place to retain Scottish industry while still providing what the Scottish people want, which is decarbonisation of the whole economy.

The Convener: My second question is for Clare Reid. How do we ensure that customers and industry remain, in real terms, environmentally friendly? Lots of people are shopping online—[*Inaudible*.]—there is more information about the products that people are buying than when they shop online. What thought is being given to that new dynamic?

What thought has been given to the issue of companies moving abroad to countries that do not have the regulations or the drive to base production on renewables or sustainable energy?

Clare Reid: There was a slight connectivity issue, but I think I got the measure of what you are asking.

I have a couple of points to add in response to your previous question. I echo what Richard Simon and Cat Hay have said about consumer choice, and we have been arguing in our research for sustainable consumer choices. I would flag up an interesting proposal for a scheme in France to introduce repair, durability and sustainability ratings for all electrical and household appliances. It would be supported by a national network of repair workshops in local communities, which is a job creation opportunity and a way of educating people about—[*Inaudible*.]—as well as making it really easy to make sustainable choices. That is one interesting example from abroad.

I am not sure that I understood your point about consumers and the impact of online shopping. Do you mind repeating that?

The Convener: I was making the point that if you go into a shop and see products, you can look at the box to see where they are made and see the name of the company. That information is more obvious there than it is online, where you might not get the full information about those sorts of things, which might affect a consumer's choice about what they buy.

Clare Reid: We have not looked at that issue specifically, but it might go back to ensuring that consumers have full information. Arguably, that should be the same whether you are buying from a household appliance seller online or in a shop. My guess is that more could be done with the retail sector to ensure that that labelling is front and centre. To go back to an earlier point about consumer choice, I think that there is a desire among consumers to make more sustainable choices.

We should be looking at the situation as an opportunity as well as a challenge for Scotland. The more forward-looking producers—and there are many in Scotland—are thinking about how sustainability can be an advantage and about how they can attract consumers. They are making that information much more visible to consumers, and they are reaping the benefits. I think that change will happen to some degree because of consumer pressure

On your second point, it is true that global capital is mobile. If we look to substantially increase our standards in Scotland, there is a risk that investment will go elsewhere. However, it is a balance, so there is also an opportunity that we need to think about. Part of that opportunity is around the resilience of our supply chain; we

might be able to nearshore some of the supply chains in the UK, so we should think about what that would look like in terms of investment.

On inward investment, there is a school of thought that says that having better sustainability standards and a decarbonised grid, making more of our natural capital resources and investing in a workforce that has the right green skills and is carbon literate is attractive to investors. There is probably a balance to be struck in setting the right standards to help the industry to reach the level of sustainability that we want, and viewing that as an advantage in attracting investment.

The Convener: I have a quick question for Cat Hay, although Graham Simpson might have covered some of this. What is a green job in the food industry, for example? Fresh food and vegetables might have been flown in from Peru or a similar country, but we just buy what is there in the shop. It is not as simple as saying that it costs too much environmentally to ship in produce from other countries. The reality is that, if we wanted to grow some things locally, we would have to bring in workers to pick them. There is a balance to be struck in that regard.

What has been done on that? How can the Government and Parliament work to get the balance right between bringing in food and bringing in workers? That international exchange is not, in and of itself, necessarily detrimental to the environment, but we perhaps need to look at how it is approached.

Cat Hay: That is a valid point. I think that we would all love to see avocados and bananas grown in Scotland, but that is some way away right now. There is a balance to be struck in bringing in those products, and a lot of that will be driven by what the consumer wants.

With regard to green jobs, there is a need to upskill the food and drink manufacturing industry. That would enable it to look within its operations in a number of areas, such as factory operations, for energy and sustainability managers, packaging technologists or people who could look at the ingredients and the supply chain and at how that works in practice.

There is currently some work on-going with Skills Development Scotland to look at future skills needs in food and drink specifically, with a massive focus on green jobs and fair work. That research is kicking off now, so there will be more to say on it in the coming months.

The Convener: Thank you. As I have said, if any of the witnesses wants to make any further points on any of the questions that have been asked, they can write to the committee after the meeting.

Colin Beattie: I have been looking at some of the opportunities and challenges in respect of the transition to a green economy. Are the witnesses aware of any country or region where industry is managing to transition away from carbon in a fair and just way? If so, what can Scotland learn from that?

Richard Simon: I am happy to jump in on that. Everywhere is beginning to make progress. Nowhere is far ahead of Scotland, but some places are a little bit ahead of us in some specific technologies, while others are far behind.

An example that was raised previously is Norway, which has a lot of renewable resources. Scotland has some of those resources, but not quite as many. Beyond that, Norway is also investigating further technologies such as carbon capture and storage. Projects are going ahead—for example, a large amount of funding is going into the northern lights project. Norway has moved first, and it is already seeing green investment coming in. People are asking it, "How much would it cost for us to transport our CO_2 to your projects?"

There is an advantage in being the first to move, but there is a risk associated with that, too. The technologies might be proven, but there is still a little way to go on linking them up into a chain of technologies. The CCS example in Norway is echoed by examples of hydrogen use in manufacturing in Japan and the like.

Colin Beattie: You said that Norway is further ahead than Scotland in some respects. I asked whether any country or region has transitioned away from carbon in a fair and just way. Has Norway achieved that?

11:45

Richard Simon: I do not know the specifics of any investigation of a just transition in Norway. It is going ahead with its investments as quite a rich country with a large sovereign wealth. On the fair and just angle, it does not seem to be losing its industry; it seems to be keeping industrial jobs in specific regions because of the public funding for the projects. It seems that, at least at a regional level and on balance, the transition is fair and just. I cannot say more than that.

Clare Reid: I cannot comment on whether the Norwegian transition has been more just and fair. However, our research identified a couple of examples. One is about the scale of commitment. We know that the green stimulus programme in Germany represents about 4 per cent of gross domestic product. Scotland's ambition is substantial, but other countries are making similar if not larger commitments.

There is an example from Austria that illustrates the stimulus that could be given to companies, whether by the UK or Scottish Government, as part of the recovery. The bailout of Austrian Airlines was conditional on the company making cuts to emissions from its flights. There is an opportunity to link support for recovery to a just transition.

Scotland is seen as having a leading approach to a just transition. In comparing countries, we might find that some are ahead on specific sectors or initiatives, such as recycling or engagement with new energy technologies. However, I would be surprised if many countries have set the same ambition as Scotland.

Colin Beattie: It is good to know that Scotland is a ground breaker on that.

We hear an awful lot about the tens of thousands of highly skilled and well-remunerated jobs that the wonderful new green economy will create. However, the other side of the coin is that I assume that we will lose highly skilled and well-remunerated jobs in, for example, the oil and gas industry. Are you confident that the new jobs will replace the existing ones and that additional jobs will be provided in the economy?

Richard Simon: We have done some work with the Engineering Construction Industry Training Board on jobs for a green transition. We have looked at what is needed in terms of skills and jobs and how we can train and upskill people. There are lots of similarities between the oil and gas jobs that you talked about and some of the jobs that are needed, particularly for carbon capture and storage. There is offshore work on renewable energy technologies as well. There are lots of similarities between the green transition jobs and the oil and gas jobs that will be replaced as North Sea oil production decreases and the transition takes place.

I cannot speak about exact numbers, but there are many similarities in the skills that are required, so upskilling will be appropriate. Also, the manufacturing and industrial regions where the jobs exist are very similar, so I hope that there will be a just and fair regional allocation without too much upheaval.

Colin Beattie: In previous evidence that the committee has taken, we have heard that 65,000 new jobs will be created in the renewables industry and the green economy. That is touted as a huge gain. However, how many of those 65,000 jobs will actually replace existing jobs as opposed to being additions to the economy?

Clare Reid: Unfortunately, we have not done any work to build on what Richard Simon said about exactly how the transition will work for those jobs. However, we know from our engagement with the oil and gas sector that there is a desire to look at how some of the highly skilled people coming out of the sector could move into the jobs.

Examples of things that would make it easier for that transition to happen include investment in the hydrogen sector and in carbon capture and storage because, if there is investment and scaling up of activity in Scotland, particularly in the north-east, and if we win one of those projects, there will be greater opportunity for that transition than would otherwise be the case. Given the nature of some of the jobs—for example, there could be up to 50,000 jobs in retrofitting domestic and commercial buildings—we can say that they would be suitable for people leaving the oil and gas sector.

Part of that will depend on whether the funding has been put into reskilling and upskilling. We have called for a fund for that. It will also depend on early engagement with the universities and colleges to ensure that that sector is geared up to provide the required volume of training in the right period of time to ensure that it can meet the demand and transition those people into the jobs before they have a period of unemployment.

Colin Beattie: Is there any validity in the idea that we will have a net increase in jobs as a result of the jobs in the renewables industry? If so, why should that be the case, given that we are replacing existing technology with new technology? Why would additional engineers and technicians be required for the renewables industry over and above what is required for oil and gas?

Clare Reid: I have not done an analysis of that, but I am sure that someone will have done one. Some of the jobs that will be created will be in new areas. Quite a few jobs could be created through the investment that is being made in peatland restoration and native woodland creation. Those are entirely different jobs. They might be more labour intensive than some of the highly skilled jobs, but they are good jobs and they are the sort of new jobs that we need. A new workforce is being created in those areas.

I cannot comment on whether there will be a net increase in jobs, but the additional investment in the other sectors that require a big investment of new labour—for example, to achieve peatland restoration and woodland creation—could offset the net loss of highly skilled jobs. As I said, I do not have the exact figures.

Richard Simon: The transition will take a long time, and lots of jobs will be involved during that period. The change will be in addition to existing and future technologies and it will require investment, which will create jobs and economic opportunities.

I echo Clare Reid's comments about new areas and new technologies, which will include negative emission technologies, greenhouse gas removal, peatland restoration, land use, biochar and the like. I also echo the point that the investment climate is moving towards green investment. We see banks divesting and energy companies such as BP changing their perspective and selling off their assets. If Scotland can position itself as one of the first movers—for example, by having Grangemouth as a low-carbon industrial cluster with access to all that infrastructure—that will provide a big draw in the 2030s and 2040s for investment and for companies that are looking for a site with that access in order to be low-carbon manufacturers.

As the markets for low-carbon products develop, the desire for those products will encourage manufacturing to switch to low-carbon processes. If Scotland has those facilities—it looks as if it is in one of the leading positions to acquire them—lots of inward investment will be possible, which will result in a reshoring of jobs and investment.

Richard Lyle: My question is for Richard Simon. Climate change is important to us all. I am not sure whether you will yet have had time to digest the contents of "Scotland's carbon footprint: 1998-2017", which was published today. It states that, between those years, our carbon footprint fell by 21.1 per cent and that between 2007 and 2017 the overall reduction was 30 per cent. Do you agree that Scotland is leading on the issue? What more could we do?

Richard Simon: Scotland is doing very well. I have not yet digested the information in the publication that you mentioned, but I think that it includes consumption emissions. I echo the points that witnesses on the previous panel made about emissions and offshoring of industry, and about how support must be maintained to ensure that our overall carbon footprint is reduced. The UK is a net importer of carbon, therefore our carbon footprint is harder to reduce than territorial emissions, on which the binding targets are based.

As for what more Scotland could do, or how it could do things better, the ambition that is set out in the climate change plan is admirable and can be achieved. Although keeping on the current course would ensure that industry does not leave Scotland, if we do not provide enough support and certainty, the investment will go elsewhere.

For example, we see a lot of investment being made in hydrogen in Germany. It has a hydrogen strategy, with specific policies in place, so industry is encouraged to invest there rather than in sites in the UK. Brexit obviously has an impact on that, and carbon markets will come out in the future. That is all that I would say on how Scotland could do better.

Richard Lyle: You have anticipated my second question. Although Scotland has a significant advantage in having both engineering expertise and geological storage, it also has competition, particularly from Teesside and Humberside. How can Scotland capture the economic and carbon storage benefits and be the best, which I believe it could be?

I put that question to both Richard Simon and Clare Reid.

Richard Simon: I will answer that quickly, then hand over to Clare.

In our advice to the CCC on the levels in "The Sixth Carbon Budget: The UK's path to Net Zero", for which we did modelling, we said that the best pathway towards net zero in industry, and towards reducing industrial emissions is fast action in all the industrial clusters. I have been encouraged by the UK Government's having upped its ambition, which previously was to achieve one cluster by 2030 and for it to be fully net zero by 2040. That has been doubled, and the hope is that ambition will continue to increase as the evidence base grows on why that should take place, and that it can do so.

Lots of existing projects are currently in competition. We need to ensure that knowledge is shared and that the competition that you mention does not become detrimental to the overall goal. Scotland is in a very good place on that. As long as the infrastructure and the planning aspects are proportional, they can capture the economic benefits of decarbonising themselves and of exporting CO_2 to Scotland from other sites that have less access to geological storage, such as those in Southampton or south Wales.

Clare Reid: I will add a couple of points about why Scotland might be better placed than, for example, Teesside. We have something like 35 per cent of the European geological storage resources that are suitable for CO_2, so we already have an advantage over such competitors because of our geology. We also have skills and infrastructure from our oil and gas sector to build on. We have the geology, the skills, the people and the infrastructure. As Richard Simon has alluded to, all we really need in addition to those are a commitment from the UK Government and a decision from the Scottish Government to invest in that and to support it.

No one is arguing that those are magic bullets for reaching our carbon ambitions, but they are part of the solution and they have long lead times. Providing certainty about the direction of travel in Scotland would help us to compete for investment.

12:00

Maurice Golden: My question is directed at Cat Hay. I declare an interest in that Cat and I used to work together at Zero Waste Scotland.

There are 750,000 tonnes of commercial and industrial food waste in Scotland, 68 per cent of which is attributed to food and drink manufacturing. Scotland has a target to reduce all food waste by 33 per cent by 2025—in just four years. Is that achievable? What is the food and drink sector doing to help to reduce waste arisings?

Cat Hay: That is an absolutely massive challenge. When research was published with food-waste figures, our organisation and others in the food and drink sector questioned some of the figures. That is not an issue; it is just that we were not sure exactly what the waste arisings were comprised of. There is a big point to be made about avoidable food waste versus unavoidable food waste. For example, meat processors will have large tonnages of what would be deemed to be food waste, but I do not think that anyone is saying that such products would be suitable for human consumption or for passing on to food banks. It is maybe more about valorisation than about stopping things going in a consumer's bins.

We and our members are very much involved in the Courtauld commitment, which is looking to reduce food waste significantly across the UK. As Maurice Golden said, I was involved in Zero Waste Scotland, so I know that the reality is that it does not make commercial sense to have food waste in processes, because it costs money. Our food and drink manufacturers are often operating on single-digit margins—some of them are extremely small—so it is important for them to look at process and at where waste is arising in their own operations.

Whether we will meet the target remains to be seen. It is a huge challenge to get there, and the target is coming in very fast. We see support on waste auditing, but there needs to be more support on how we implement changes.

Maurice Golden: The next question is about public procurement. The Procurement Reform (Scotland) Act 2014 seems not to have moved the dial in terms of shifting procurement towards a more green and sustainable direction. Cat, do you have any thoughts on that before I ask the rest of the panel?

Cat Hay: The biggest opportunity for green procurement for food and drink manufacturers is probably in procuring renewable energy.

Maurice Golden: Anyone else?

Richard Simon: On the procurement side, I emphasise low-carbon products, because there are not many of them out there at the moment. We need the initial catalysis, either to create the infrastructure to enable low-carbon hydrogen and low-carbon CCS, or to create the circumstances in which electrification can happen. After that first initial investment, green procurement will seed more results, I suppose. Without that, a little shift in thinking is needed, and a bit more encouragement of businesses and companies to look towards greener and decarbonised manufacture is needed.

However, that shift will be very small compared to the scale of the energy-cost implications. Sites will not investigate that on their own without commitment from Government, either on the on-going costs through business models, industrial fuel switching or CCS, or catalysing the initial investment.

Clare Reid: I have a couple of points to add to that. We are very interested in how community wealth building can support the change. A couple of examples, including one in Ayrshire, are looking at more focused investment locally—in particular, investment that creates green jobs. We are interested to see how that plays out and, eventually, how it impacts on greener procurement. It is quite early days, but there are some interesting signs.

If we think about the scale of public procurement in Scotland every year, it undoubtedly has a role to play. I suggest support for training, investment in procurement professionals and, potentially, requirements for certification of certain goods. For example, there is in the forestry sector a requirement to demonstrate where goods have come from. There is scope to bring certification into the supply chain or to require further investment by firms. The built environment sector has responded positively to that, particularly through introducing new net zero and circular business models.

There is a lot of scope, but what is needed is support by investment in research and development—for example, for trialling and developing business models for the things that we would like to see industry do. The change also needs to be supported by upskilling plans so that industry has the right skill sets to deliver the low-carbon products that we want it to deliver. Public procurement definitely has a role to play, supported by investment.

The Convener: I thank our witnesses for joining us virtually. The committee will now move into private session.

12:06

Meeting continued in private until 12:24.

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