



**OFFICIAL REPORT**  
AITHISG OIFIGEIL

# Economy, Jobs and Fair Work Committee

**Tuesday 7 February 2017**

**Session 5**



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**ECONOMY, JOBS AND FAIR WORK COMMITTEE**

**5<sup>th</sup> Meeting 2017, Session 5**

**CONVENER**

\*Gordon Lindhurst (Lothian) (Con)

**DEPUTY CONVENER**

\*John Mason (Glasgow Shettleston) (SNP)

**COMMITTEE MEMBERS**

\*Jackie Baillie (Dumbarton) (Lab)

\*Bill Bowman (North East Scotland) (Con)

\*Ash Denham (Edinburgh Eastern) (SNP)

\*Richard Leonard (Central Scotland) (Lab)

Dean Lockhart (Mid Scotland and Fife) (Con)

Gordon MacDonald (Edinburgh Pentlands) (SNP)

\*Gillian Martin (Aberdeenshire East) (SNP)

\*Gil Paterson (Clydebank and Milngavie) (SNP)

\*Andy Wightman (Lothian) (Green)

\*attended

**THE FOLLOWING ALSO PARTICIPATED:**

Kersti Berge (Office of Gas and Electricity Markets)

Andy Burgess (Office of Gas and Electricity Markets)

Professor Stuart Haszeldine (University of Edinburgh)

Jenny Hogan (Scottish Renewables)

Julian Leslie (National Grid)

Christine MacKenzie (SSE)

Lindsay McQuade (ScottishPower Renewables)

Nicola Pitts (National Grid)

**CLERK TO THE COMMITTEE**

Alison Walker

**LOCATION**

The David Livingstone Room (CR6)



## Scottish Parliament

### Economy, Jobs and Fair Work Committee

Tuesday 7 February 2017

*[The Convener opened the meeting at 09:30]*

### Decision on Taking Business in Private

**The Convener (Gordon Lindhurst):** Good morning and welcome to the fifth meeting in 2017 of the Economy, Jobs and Fair Work Committee. Agenda item 1 is a decision by the committee on whether to take items 3 and 4 in private. Does the committee agree to take those items in private?

**Members** *indicated agreement.*

**The Convener:** I have received apologies from Dean Lockhart and Gordon MacDonald. I ask everyone to turn off or switch to silent any electrical devices that might interfere with the work of the committee.

## Draft Climate Change Plan and Energy Strategy

09:30

**The Convener:** We come to our first panel of witnesses this morning. I ask the witnesses to indicate that they wish to come in on a question or a discussion by raising their hand. The sound desk will deal with the microphones, so there is no need to press any buttons.

I welcome Christina MacKenzie, public affairs manager for SSE Scotland, Jenny Hogan, policy director for Scottish Renewables, Lindsay McQuade, policy and innovation director for ScottishPower Renewables, and Stuart Haszeldine, professor of carbon capture and storage at the University of Edinburgh. I thank all our guests for coming this morning.

I will start with a general question before we come to specific questions from other committee members. You will be aware that we are looking at the Government's climate change plan and energy strategy. Would each of you like to comment on, criticise or question the key points for your area of interest?

**Christine MacKenzie (SSE):** In general, we are very positive about both documents and we welcome the ambition in them. Something that needs to be explored in more detail is a route to market for some of the more ambitious technologies, including carbon capture and storage, pumped storage and even the future upwards trajectory of onshore wind, for reasons that most people will be aware of. I realise that these are consultations, so we will put in full responses to both of them.

**Jenny Hogan (Scottish Renewables):** Good morning. I echo what Christine MacKenzie has said in that we welcome the high level of ambition in both the draft energy strategy and the draft climate change plan. In particular, we welcome the target to deliver 50 per cent of energy demand from renewables by 2030 and the taking of a whole-system view. Scottish Renewables made both those proposals, so they are very welcome.

We recognise that the achievement of a substantial part of the target will rely on United Kingdom Government policy—particularly in respect of the route to market, as Christine MacKenzie mentioned—and, to some extent, European Union policy. However, it is important that the Scottish Government has set this high level of ambition and vision for Scotland. Of course, it can use its devolved powers as far as possible, while working closely with the UK

Government to maximise the use of reserved powers.

Both documents are quite high-level strategies, which do not have much detail on delivery. There is a lot in there, although much of it is a restatement of current policy. We would welcome more detail, and we recognise that much of that is still to come through the consultation processes. We would welcome some more detail on the relative benefits of some of the policies, as well as further impact assessment of those policies.

**Lindsay McQuade (ScottishPower Renewables):** As the others have said, we welcome the publication of the climate change plan and the accompanying energy strategy. We are particularly pleased to see that the TIMES model has been used to effect in the publication of the climate change plan. That gives a clear steer for policy direction and desired policy outcome, which is an excellent context in which to set the ambition.

We passionately support the 66 per cent target for a reduction in emissions. It aligns with a number of our corporate objectives. We are part of the Iberdrola group, which has a global target of reducing its emissions by 50 per cent by 2030 and being a carbon-neutral power generator by 2050. The Scottish Government's ambition chimes with our strategic directives as an organisation.

We have spent some time looking over the CCP and the energy strategy and will take further time to consider the questions that they raise. We note that they are ambitious and it is helpful that they have that shape that we can work towards. We look forward to responding to the consultation.

**Professor Stuart Haszeldine (University of Edinburgh):** As has already been said, Scotland is a terrific place to be working, because the ambition is good and it is the right ambition: it is founded on climate science evidence and takes us on the right trajectory to 2050. I see both the documents as part of a pathway to 2050—2032 is a stepping stone on the way to 2050 and has to be aligned with the direction of travel.

We are particularly pleased to see the integration of a whole-energy-system model, which makes different parts of the energy spectrum take responsibility for their actions and, as an integrated portfolio, makes it impossible for people to blame each other for lack of delivery. A lot of the route to delivering that is uncertain at the moment. In particular, bigger items may depend on UK policy, although Scotland has been very successful at finding niches and ways through that. However, that will get a lot more difficult.

We have had great success so far in decarbonising and in providing renewable electricity by closing down a lot of the older, high-

carbon equipment that was previously in use, but to go forward having less and less carbon and more and more sustainable energy will require a lot more innovation and invention than we have been accustomed to in the past. If I represent part of the university sector on this panel of four, rather than the commercial delivery sector, I would say that we have to work together on that.

**Gillian Martin (Aberdeenshire East) (SNP):** I have a question for the people representing the electricity sector. Can you take me through your progress to date on cutting the emissions as set out in the previous climate change plan? How have you achieved that so far?

**Jenny Hogan:** In Scotland, so far we have displaced about 13 million tonnes of carbon dioxide through renewable energy and, in particular, through renewable electricity. That is a huge success so far, and the development of many projects is in the pipeline.

We currently have about 8GW of installed renewable electricity capacity in Scotland and the strategy to 2030 plans for additional capacity ranging between 11GW and 17GW. We had proposed a doubling of renewable electricity capacity—going from 8GW to about 16GW—so we would be pushing towards the high end of that range. That capacity is in the pipeline as long as various policies allow it—that brings us back to the point about the route to market relying on the UK Government to allow all technologies, both those that are established and those that are less established, to compete for long-term contracts for power.

However, the Scottish Government has many powers that it can use to help the industry to reduce costs, through planning, business rates and other forms of regulation.

**Gillian Martin:** Are the targets that have been set in this climate change plan achievable?

**Jenny Hogan:** We also proposed the 50 per cent target and we believe that it is achievable, although it is very ambitious, as the strategy recognises. As I mentioned, whether the target can be achieved relies on UK Government policies and, to some extent, EU policies. We have to be realistic about that and accept that not everything is in the Scottish Government's gift. However, if the Scottish Government uses its powers as far as possible, works closely with the UK Government and watches what is coming through in EU policies and how they are transposed in the UK, the target is achievable.

**Gillian Martin:** That is the elephant in the room—we are coming out of the EU. The question will be to which Government certain powers go. Would you like to lobby on that question of which

powers from the EU that would affect your meeting your targets go where?

**Jenny Hogan:** At this stage, we do not have a clear position across our membership on which specific policies we would want to come across. The main thing for us is being able to compete in a similar way to how we can now in trading with European countries and beyond. Currently, we have access to the integrated energy market, and we look forward to seeing how the abilities that we have now can continue. There are lots of different options for how that might happen under different scenarios. Continued access to skilled staff is also important to the industry. As for what model might come forth, however, that is still to be discussed.

**The Convener:** Gil Paterson wanted to ask a supplementary question, and Stuart Haszeldine also wishes to come in. I will let Gil Paterson ask his question first.

**Gil Paterson (Clydebank and Milngavie) (SNP):** If you do not mind—thank you, convener. My question relates to targets. Will the fact that subsidies have been cut impact on the Scottish Government's targets? Is it likely that the private sector will invest to replace that subsidy?

**Professor Haszeldine:** That is a hard question to answer. I wanted to comment on the change in European membership. The EU emissions trading scheme has been an overarching umbrella to guide our pathway to emissions reduction for much of what the UK has done in electricity generation and in industry emissions. As a result of leaving Europe, that overarching system will disappear as an obligation. The question is whether we will have a shadow system in the UK that will dictate a trajectory and enforce an overall carbon price across the economy, or whether we will abandon that and take responsibility, either sectorally or as different parts of the UK, for delivering our trajectory on that. To me, that is a major change. In the European trading system, it was very likely that attempts would be made to push up the carbon price from its present €5 per tonne of carbon dioxide up towards €20 or even €40 per tonne of carbon dioxide. Knowing whether we are going to go along a similar or parallel pathway will dictate the economics of the delivery of all that.

**Lindsay McQuade:** To answer Gillian Martin's questions first, ScottishPower Renewables has made a significant contribution to decarbonisation in Scotland. We have an established portfolio of around 1,400MW operating in Scotland, and we are constructing about £1 billion-worth of onshore wind assets. Turning to Gil Paterson's point about subsidy, I note that that was done under the previous regime, the renewables obligation, which has successfully established an onshore wind sector in Scotland. We acknowledge that the

scheme was due to end in 2017, and there have been changes, but a grace period has been allowed to ease the impact on investor confidence. That has been relatively well managed, and we continue to have the confidence to invest in our pipeline.

Looking ahead to our route to market and to encouraging a level playing field between technologies, we would like onshore wind to continue to have a role. I am pleased to note that, in the documents that have been published, there is clearly a future requirement for onshore wind to continue to contribute, which is helpful.

On cost reduction and competition, the implementation of a framework such as the CFD—the contract for difference mechanism, which has gone through one round—is successfully driving down the costs of renewables, reducing the burden on consumers. Having access to a competition and an auction is a helpful way of continuing to give investors confidence that there is a mechanism that they can invest against to bring forward further capacity while protecting the consumer from the change that we need to enable in order to achieve decarbonisation targets.

09:45

**Gil Paterson:** In essence, you think that the private sector is able to pick up the ball and run, and that the costs are of such a nature that the work is self-financing and does not need the subsidy element. Is that what you are saying?

**Lindsay McQuade:** A framework is required to sustain the investment. There is no form of new investment in new generation happening just now, because the wholesale price continues to be volatile. The forecast is difficult. Nobody has the perfect crystal ball that tells us what the prices will be against the long-term assets that we are investing in. That is particularly so for renewables, with their up-front capex intensive investment. We cannot hedge against how and when the wind will blow—we cannot hedge against input fuel, if you like. That creates a need for some certainty about revenue in order to facilitate the investment and to attract capital efficiently, so that we are not pricing risk unnecessarily into that investment.

There is possibly a role for corporate power purchase agreements—PPAs—although I am not sure that that is where you were going. The Government-owned energy company, or GOEC, that has been proposed in the documents is an interesting concept, and I would be pleased to understand more about it and to have further discussions with officials about it. We will be answering that point in the consultation.

It is important to note that the corporate PPA market is a niche market, and it would not

necessarily sustain the capacity that Jenny Hogan mentioned of between 11GW and 17GW, which we see as the level that is required to achieve our decarbonisation targets.

Although those routes and mechanisms can operate in parallel, it requires a consumer at the end, who is willing to pay a premium for green energy, to provide that stability. There is a need to fund that investment. Over the long term, there is a move back—also through the CFD mechanism—to having money over and above the wholesale energy price being returned to consumers. We are looking for that certainty and that risk mitigation tool to sustain the investment in the pipeline.

**The Convener:** Richard Leonard wishes to come in with a supplementary question, and Christine MacKenzie and Stuart Haszeldine wish to provide an answer.

**Richard Leonard (Central Scotland) (Lab):** My question is for Lindsay McQuade and Christine MacKenzie in particular, and it picks up on the point about the exceptional levels of investment that there have been in renewables over the past decade and a half. Perhaps you could tell us a little bit more about the extent to which Scotland's manufacturing base has been developed, Scottish jobs have been created and Scottish steel making has benefited from that level of investment. If you cannot tell me about that this morning, perhaps you could supply that information to us. I reflect, in particular, on the Beatrice offshore project. I know that the fabrication work is being conducted in Scotland in part, but two thirds of the construction is in Denmark and Holland.

**Christine MacKenzie:** I will come back on a few of those points. On the point about onshore subsidy, it is disappointing that there is currently not a route to market, but we are still enthusiastic that that might come about. As Lindsay McQuade said, there is a job to be done in looking for a framework that might open the route to more onshore wind. We have not given up on that. After all, onshore wind continues to be the cheapest low-carbon-generation form of energy that we can build, and it can support local supply chains in a way that other renewable sources cannot so well.

To return to Gillian Martin's point, emissions reductions in the power sector have been driven by a combination of huge investment in renewables under UK-wide policies and the reduction in coal use. When it comes to Brexit, from SSE's perspective, the key thing that we want to maintain is the electricity market reform—EMR—principles. It would be good if elements such as the CFD auction, the capacity market and the carbon price floor can remain intact. We also want to keep trading with the European Economic Area and the European Community in energy.

Keeping energy supply stable is in everyone's interests, and we are hopeful that that can be achieved.

To pick up on something that Lindsay McQuade said, we are optimistic about the Scottish Government's proposals on PPAs, but much more needs to be done to explore how they would work and whether they would provide a solution.

Beatrice represents £2.6 billion of investment. Beatrice is offshore wind, so it is slightly different, as there is still a mechanism in place to support it through Government support. At SSE, we use as much indigenous supply as we can. We have just had great contracts awarded with BiFab and Babcock in Rosyth, and Wick harbour is being renovated—90 jobs have already been created up there. We do as much as we can, but I will come back to you on the exact detail of what we are sourcing from abroad and what we are sourcing from within the UK supply chain.

**Professor Haszeldine:** It sounds to me as though a lot of this discussion has been about electricity delivery, but it is very clear from the energy strategy and the climate strategy that at least 50 per cent of our energy demand is for heat. We also face the challenges of decarbonising transport and protecting our industry from emissions charges, and I have not yet heard any conversation about how to do all those things.

Price support mechanisms such as a renewable heat incentive fall within the remit of the UK Government. There is a lot of wishful thinking about how we can support our industries to avoid carbon leakage, closure or migration to other parts of the world. We should perhaps think about taking an even more positive view and being assertive through the creation of low-carbon industrial zones that act not to preserve the past but to attract future low-carbon industrial manufacture and thereby generate low-carbon industrial exports from Scotland. Powering those, or supplying heat and power to those, is a slightly different question from what we have just been talking about, but it is a very big question indeed.

**Lindsay McQuade:** I come back to Richard Leonard's point about the supply chain. It is interesting that, as Jenny Hogan mentioned, we have just over 8.3GW of installed capacity, and I believe that another couple of gigawatts of capacity is under construction as we speak. That represents a sizeable proportion of generation in Scotland. In addition, 43,500 people are employed in the low-carbon and renewables sector in Scotland, so it is a significant employer with a skilled workforce that offers good and interesting careers.

With regard to the installed capacity that we have, although there is limited opportunity to bring

in a wholesale manufacturer of wind turbines, there is an opportunity with regard to the components. For example, CS Wind has invested in Campbeltown and Machrihanish, and it continues to be used locally.

There is also a huge opportunity in terms of the consumables of those sites, and we have been talking to the enterprise agencies about remanufacturing, with a view to extending the longevity and the life-extension prospects of our installed capacity so that we can continue to get good, productive clean energy from those assets that we have already invested in. I am talking about things such as blades and gearboxes—the more consumable parts of the turbines. Classically—this is picked up in the documents that have been published—a planning consent was issued for 25 years. At the point of consent, that was the best estimate of how long such assets would run for. Now that we have gone through the experience of operating those assets for a prolonged period, we understand that there is more that they can do. If we selectively invest in key components, we can extend their life and extend production. It would be interesting to work on supply-chain strategies to see what we can cultivate in Scotland to support such plant.

**John Mason (Glasgow Shettleston) (SNP):** Professor Haszeldine, you said that we are expecting reduced emissions from electricity in comparison with other areas such as the service and residential sectors. Are we being unrealistic? Are we expecting too much of a reduction from electricity in comparison with other sectors?

**Professor Haszeldine:** We have done phenomenally well on reducing the carbon intensity of our electricity—it has reduced to something like 200g per kilowatt hour, so it is extremely low. I am certain that we can make further progress on that with the renewable electricity developments that we have talked about—I am certain that we can deliver that. It may cost more than we think, if Scotland has to bear the full cost; at the moment, a lot of the cost is smeared out among the whole of the UK. I do not think that we fully account for that.

We must also realise that, even with all that renewable capacity, renewable delivery is still intermittent: it is variable through time. There are periods of the year—hours, days or even weeks at a time—when the delivery of electricity from wind power is nothing like the demand. It is not clear to me, at the moment, that Scotland can go it alone, because we need interconnectors to other countries—England and perhaps countries in Europe—that allow us to import electricity as and when necessary. We do that now; the closure of our thermal generating plant means that there is a lot more arbitrage between Scotland and England

than there used to be. We need to develop our thinking about how we will store delivery of electricity.

On heat delivery to houses, businesses and industry, the graphs in the energy strategy, for example, show that the demand for heat varies by a factor of six through the year and the heat energy supply is four or five times the electricity supply. How to decarbonise heat will be a much more significant question. We have a choice; we could electrify everything and deliver heat through electricity—at the moment, that would be an expensive way to do it—or we could deliver heat through other energy vectors such as hydrogen, as discussed in the documents, which to me seems a very plausible method. However, we then have to think about how to supply that hydrogen at a feasible cost. The cheapest way of providing hydrogen is through fossil fuel conversion—

**John Mason:** We will come on to that; some of my colleagues have questions about that.

**Professor Haszeldine:** Delivering all that electricity seems very doable. To deliver the other three quarters, we are still in the realm of needing to know the direction of travel, and to invent and innovate on the way. It is premature to decide exactly how to do that delivery. It is sensible to renew these types of documents every few years and review where we have got to; we cannot make final decisions yet.

**John Mason:** You have laid out the challenges that each sector faces. Are you happy that we go ahead with expecting quite a lot from electricity, and see what happens in a few years' time? Should we reduce our expectations of electricity and increase our expectations of other sectors?

**Professor Haszeldine:** I will repackage your question slightly. We should continue to develop renewables at appropriate cost, as outlined by the three other witnesses, and start to work very seriously on how we will deliver reductions in emissions from transport, industry and heat. Those are much bigger challenges than we have faced so far. We should continue to steer as we are on electricity and expect 100 per cent renewable electricity as the default position. To solve the other challenges needs a lot of serious work, which needs engagement with other actors.

**John Mason:** Okay; thank you very much. I move on to the question of how much installed renewable capacity there is. Miss Hogan referred to 8GW—is that correct?

**Jenny Hogan:** Yes.

**John Mason:** Our figures have quite a wide range of 11GW to 17GW by 2030. If I am correct, the Committee on Climate Change has a different figure for 2020 of somewhere in between. A lot of

figures seem to be floating around, and 11GW to 17GW seems a very wide range. Is that just the way it is? Do we need to pin it down a bit more? I ask you to explain that.

**Jenny Hogan:** I was going to come back to that point, which is important to highlight. Yes, it is quite a wide range. I said earlier that we are keen to focus on the higher end of that range; we believe that we need to double existing capacity up to 2030, which would need a 16GW or 17GW range. The figures are aligned with those of the Committee on Climate Change and others, such as WWF in its recent analysis. They all call for about a doubling of capacity by 2030, so I would say that they are all more or less in the same ballpark.

To relate that to the previous question, CCS clearly has quite a big part in the Scottish energy strategy, in which it is seen as being critical to meeting the targets. We do not have a view on CCS or other non-renewable technologies, but it would seem prudent at least to aim for the higher end of renewable electricity generation, in case more nascent technologies take longer to develop or there are issues with meeting the expectations in the strategy, given that the newer technologies are at an earlier stage and that so many of the renewable technologies are already mature and are in the pipeline and more or less ready to go.

10:00

I will perhaps just touch on the subject of heat. The strategy is very ambitious on that, which is great. I agree with what Stuart Haszeldine said about that being absolutely critical. It really has been the Cinderella of renewable energy policies and, more widely, low-carbon energy policies.

The targets for 94 per cent of non-domestic buildings and 80 per cent of domestic buildings to move on to low-carbon heat technologies by 2032 are very welcome, but very stretching. There is not yet a huge amount of detail in the strategies to say exactly how those targets will be met. There seems to be quite a lot of back-loading, so that not much seems to be happening until 2025 and then suddenly there is quite a big drop. We question that. Is there not more that we can do on renewable heat now? Technologies are available—both renewable and low-carbon heat—and we should look particularly at off-gas-grid areas and district heating in urban areas. We urge the Scottish Government to move as quickly as possible on the regulation and on other policy measures on heat.

**John Mason:** Thank you. Some of my colleagues will perhaps delve into that a bit more deeply.

**Ash Denham (Edinburgh Eastern) (SNP):** Good morning. Quite a bit of emphasis has been put on CCS as part of the strategies, and the Scottish Government has said that it would like to see the UK Government strategy aligned with Scottish energy priorities. However, there does not seem to be any mention of CCS at all in the recent industrial strategy consultation that the UK Government put out, so it seems that that might not be the case in the future.

If we look at bioenergy combined with CCS, or BECCS, Biofuelwatch said that it is overhyped, that massive scale-up is unproven and that it would be highly complex. Will the panel give views on the feasibility of CCS, with those other technologies, delivering negative emissions in the future?

**Christine MacKenzie:** I will start. From a business point of view, we had potential with Shell's CCS project at Peterhead. However, a year ago from the autumn statement—that is, in 2015—we had the announcement that that would no longer be the case. Therefore, since then, CCS has not been something for which SSE has been expecting any realistic route to market, from any Government—UK, Scottish or otherwise.

SSE works on the basis of a mix of energy sources. We are the largest renewables generator in the UK and Ireland, but we have a range of sources across the Great Britain and Ireland network. Given the technology behind CCS, and the mechanics of it, we would not have a strong view that it should be pushed or otherwise. If another opportunity were to come up in a business context that might make it feasible, we would probably look at it, but, at the moment, we have not seen anything that suggests that that might happen any time soon.

**Lindsay McQuade:** I echo what Christine MacKenzie said. As the committee is probably aware, we undertook the largest-ever study of a coal-fired power station in the feed study that we undertook at Longannet with a view to establishing a 300MW CCS project. That study was completed and the submission made to the UK Government. Unfortunately, the price point was too high. At £1.5 billion for a 300MW project, the feeling was that it was just too expensive against the £1 billion cap that the UK Government had set.

When we look at the cost of other technologies in there, and particularly the impact as it comes back to the consumer, we have to be very mindful of what we are actually asking the consumer to support through their energy bill. Having a competitive allocation for the most cost-effective technologies to come in and decarbonise the network is something that we should be looking at. CCS could play a role in the future, but, right now, the price point is just a bit too high for us. That

said, if in the future there were an opportunity to see that change, it is certainly something that we would look at from a business perspective.

**Professor Haszeldine:** I have several points to make on carbon capture and storage. First, it is important to realise that, in the past 10 years, we have been dragged into a conversation about CCS being applied to electricity generation because of the UK Government's obsession with fitting CCS in order to decarbonise coal-generated electricity. It has been really difficult for it to compete with established low-cost electricity. It is difficult to compete and to innovate anything big into the space where established electricity producers are either running off power plant that has already been paid for and therefore has very low marginal costs, or running renewables, which have their own price subsidy and are therefore difficult to compete against. It is therefore no surprise that CCS has difficulty on power plant.

Secondly, the UK Government set the competitions up in such a way that a huge amount of business risk and business problems were left with the developer, and that was priced in to the very high prices that we have just heard about. I contrast that with the situation in other parts of the world where low-carbon electricity is being delivered for about £100 per megawatt hour, which is about two thirds of what we were quoted in the UK. That is not to do with the technology; it is to do with the way the UK has chosen to develop it.

CCS is not a single gadget but a way of reducing carbon emissions in the energy system. If we think about how we are going to travel down the route of effective, low-cost decarbonisation, it is instructive to note that the TIMES model chooses to use carbon capture and storage because that model is about optimising the low-cost delivery of decarbonisation across the whole energy system. It is not just about choosing CCS for electricity; we can choose CCS for heat, transport and industry, because it applies to all those areas. We should get out of the conversation where we think about only one direction for carbon capture and storage.

Thirdly, if we think about how we are going to decarbonise our industry emissions from, let us say, the east of Scotland and the Grangemouth complex, CCS is the key way of doing that, and we need to address that for the future. If we are going to supply low-carbon heating through the means of hydrogen, we have to generate the hydrogen, and CCS is a key part of that delivery. If we think about how we are going to supply low-carbon transport, we could do that through electric vehicles, but perfectly valid technologies are also emerging for hydrogen fuel cell vehicles. They could provide much more consumer-facing and

consumer-friendly vehicles, and the hydrogen, again, can be supplied through the medium of CCS.

Fourthly, we have thought about this involving very big projects that are driven by the UK Government, but carbon capture and CO<sub>2</sub> separation from industrial wastes is going on in Edinburgh right now. It can happen at small scale, medium scale and large scale, not just at immense power plant scale. Part of the proposal that we have put forward from the University of Edinburgh and the Scottish carbon capture and storage group, which I can send to the committee later, is that we should think about multiple tracks.

In Scotland, we do not have control over very large investment in power plant, which is a UK control, but we have the ability to develop carbon capture, transport and storage for small and medium-sized enterprises such as combined heat and power plants that use biomass, brewing and distilling, local small power units, paper making and glass making. All those wealth-creating Scottish industries are going to need to decarbonise in the future; they will all need to decarbonise their emissions before they get closed down by the European emissions trading scheme or whatever its replacement will be, so we have to start now. We can start now and develop all those types of low-carbon application.

This is not just about electricity. It is about looking at decarbonising the whole of our energy economy.

**Ash Denham:** We had questions about whether CCS should be plan A. You seem to be saying that it is certainly part of the initial plan and we should not discount it at this stage but it would need to be used along with other measures. Is that a fair summary?

**Professor Haszeldine:** I am saying that capturing carbon dioxide emissions is absolutely part of plan A but plan A is not just about electricity. As is correctly pointed out in the TIMES model, plan A is across the whole of energy use in Scotland. In the climate strategy, it is portrayed that we should go to negative emissions from 2027 onwards and that that should continue. Negative emissions are part of the trajectory towards 2050 because, under the Paris 2015 United Nations agreement, we expect to have a net zero economy around 2050.

As part of our emissions portfolio right now, we claim about minus 10 million tonnes of carbon a year from forestry use. That is accounted for by growing the trees. If we want to convert those trees by burning them as biomass—that was part of your earlier question—we must remember that just burning them and putting the carbon back into the atmosphere is only part of the value. The true

value is in taking the carbon out of the atmosphere into trees, creating a rural economy by reforestation large areas of Scotland and using those trees in construction and in fuel but taking the carbon dioxide emissions and putting them underground.

You are right that BECCS—biomass energy with carbon capture and storage—does not exist on a commercial scale. There are isolated examples around the world where carbon capture is happening on emissions that are derived from biomass by making alcohol, for example. It is straightforward to capture the carbon dioxide from those sorts of emissions. We could do that in Scotland on our distilling and brewing industries, for example. Those carbon dioxide emissions are going into the atmosphere as pure carbon dioxide, but we could and should be thinking about capturing them now. There is no need to wait for that.

It would be fine to do combined heat and power schemes using biomass, but those schemes would still emit carbon into the atmosphere. It does not matter whether the carbon is from biomass or fossil fuel—it is still carbon. Therefore, if we are going to do combined heat and power schemes, we need to work out how we will catch the carbon from the fuel sources in those schemes, whether it is natural gas or biomass. We have not thought that through yet. We need to start off on the research push and development push for that in conjunction with power and heat vendors. That can be done.

There are clear examples, as I think even Biofuelwatch will admit, of the gasification of biomass, which is a much more efficient way of using it. The gasification step is difficult but is claimed to have worked in a few instances round the world where there has been close co-operation between research and development and an equipment developer. In Scotland, we face the innovation frontier because we are one of the first countries in the world to get as far as we have got. We now face the cutting-edge challenge of what to do next and how to invent and develop the new technologies that we will need to get down our low-carbon trajectory and the low-carbon technologies that we can then design and sell on to other countries. It is an opportunity to develop something new, not a burden.

I repeat that it is not just about renewable electricity but about decarbonising the whole economy. That is clear from all energy models, not just the TIMES model, which we have run on Scotland. Other countries have run TIMES models or whole energy system models. Carbon capture and storage is always included as an essential part of the whole-system energy model. We can go away and run our TIMES model again and again for Scotland but it will always come out with

the result that we need CCS as an essential part of that all-energy system low-carbon delivery.

10:15

**Bill Bowman (North East Scotland) (Con):** I will read out the following from the Scottish Government's energy strategy, because it is quite important. The strategy states:

"in the absence of adequate storage capacity, thermal electricity generation is required to provide important base-load capacity and support the resilience of the electricity system."

Is new thermal base-load capacity necessary or desirable—or both? How might it be built, given the electricity industry's current reluctance to invest in new plant?

**Christine MacKenzie:** National Grid can probably go into great detail on that, but from our point of view, we do not think that less thermal capacity in Scotland, for example, is problematic to security of supply, because we are part of an important GB-wide marketplace and network. That is where support for security of supply comes from at the moment. We would welcome increased flexibility in Scotland, given the new renewable assets that are coming on stream, but that is probably a different topic. I would leave the detail on that to National Grid.

**Lindsay McQuade:** The role for new thermal is challenging in Scotland and that is in part attributable to the transmission charging regime. National Grid will be well placed to respond to questions on that in the next evidence session. Clearly thermal sites have been decommissioned in Scotland, but at the same time there has been extensive investment in the infrastructure and network to ensure that we can continue to supply customers with the energy that they need. We are investing roughly £3 million a day between our networks and our renewables business to ensure that power gets to where it can be consumed. A lot of investment is happening in Scotland, and we envisage the network continuing to work harder to transmit cleaner, greener energy to our consumer base.

More specifically on flexibility, we have worked with industry colleagues and Imperial College London on evaluating the impact of increasing renewable generation, with increased flexibility, on the network, and that work is considering various types of storage from large scale such as pumped hydro through to batteries and the domestic scale. In essence, we need a bit of everything. No single technology will solve the storage issue, but having that storage and back-up capacity allows us to make the network work much more efficiently and effectively with the renewable capacity that we have.

The analysis from that publicly available report shows that if we invest relatively moderately in flexibility, we can very efficiently reduce the overall costs associated with running the electricity network to the tune of £7 billion a year compared with current costs. With the increasing volumes of renewable generation that the energy strategy has in part proposed and some moderate improvement in flexibility, we can get a fully functioning network.

**Jenny Hogan:** I echo what has been said and emphasise the role of storage in the system. Ofgem and the Department for Business, Energy and Industrial Strategy have recently called for evidence on flexibility options for the electricity system, and energy storage is a crucial part of that. In addition, the UK's recent industrial strategy is very strong on storage and other forms of flexibility, so UK-wide, it is clearly seen as a key part of the mix to come. The importance of that should not be underestimated, and it will be particularly important given that the strategy seems to suggest increased electrification of rail, road and heat networks in Scotland.

The other point to highlight is the completion of the western high-voltage direct current cable in 2016-17—or later this year—which will significantly enhance the transmission system's capability and enable transfers from England and Wales to Scotland of up to about 3.9GW. Again, National Grid and Ofgem can give you more detail on that, but that increased capacity will obviously have a big impact on the amount of increased generation that we can sustain in Scotland.

**Professor Haszeldine:** I am much less sanguine about the absence of storage capacity. I agree that we have storage to manage variable delivery on a timescale of minutes, hours or even perhaps a day with pump storage capacity, but we have no ability to handle a shortfall of renewable generation over multiple days.

It is clear from weather patterns that that sort of thing happens regularly across the UK and large parts of Europe. Even if we relied on interconnectors and electricity generated in Europe, there would still be periods when the immediately surrounding seven, eight or 10 countries would have no or very little renewable wind generation. It remains an entirely unanswered question about how we obtain secure and resilient supply without thermal generation.

The problem that we face is that National Grid has developed a UK-wide transmission charging policy and a UK-wide model for delivering electricity at a low cost, but that does not take into account regional generation patterns and security. Scotland is an important region of the UK, but we have lost our embedded thermal capacity for generation at Longannet and Cockerzie, and Peterhead is running only part time as back-up

capacity. It remains an entirely open and unanswered question what happens if there is a lull in the wind as a result of a blocking high-pressure weather system that goes on for four, five or six days and we need to supply a large amount of ordinary electricity or if we have electrified our rail system, are supplying electric vehicles and are trying to supply electrified heat. We do not have the storage capacity to back that up.

There are therefore good reasons to suppose that we should look at how we back all that up. We have got through the past few weeks by importing electricity from the rest of the English grid through existing interconnectors and through demand reduction. In future, we might want to consider a regional pricing system for the generation of electricity that would enable gas-fuelled power plant or integrated plant to supply either electricity or hydrogen from the same plant, as in the Summit Power proposition for Grangemouth. We could choose to provide electricity, hydrogen or heat from that.

We could also provide the CO<sub>2</sub> takeaway service for that. Successive propositions have been made for carbon capture and storage for Scotland, because Scotland has all the infrastructure needed to provide easy access to a thermal generation plant developed to take carbon dioxide away. We have the pipework infrastructure both on land and offshore. The storage sites have been assessed and are ready for development as a result of previous UK projects, as Scottish Power and SSE have pointed out; well over £100 million of UK Government investment has been made in all that and those systems could, if we wanted, be up and running by 2020 or 2021. That kind of low-carbon reinforcing development would support the types of renewable electricity delivery that we have heard about and would allow us to move forward with heat delivery, which is another issue that we have not solved.

**Lindsay McQuade:** I just want to pick up on a couple of points that have been made. On investment in new-build gas, the capacity market that Christine MacKenzie mentioned earlier is an effective tool for stimulating that. The effectiveness of that policy intervention has been partly frustrated by the pricing point of some of the technologies that are winning in that auction, with aged plant being able to compete effectively in the auction and outstrip any development of new generation. That is of concern to us and we would like to see the mechanism reviewed to ensure that the policy does as intended and brings forward new-build gas.

As for where the new-build gas would be located, the pricing signals right now show that the locations would tend to be in England and Wales,

but because the 4GW HVDC connection that Jenny Hogan mentioned is bi-directional, we can export to England and Wales when the wind blows in Scotland, and we can import generation from England and Wales when it does not. The bi-directional nature of the power connection is novel; it is something that we have not had in Scotland before and it partly removes some of the constraint that we have experienced. It is helpful to see such a change coming through, and there are plans afoot for further enhancement and upgrade of the network, too.

**Andy Wightman (Lothian) (Green):** I want to move on to the residential sector, for which there is quite an ambitious target of a 76 per cent reduction in emissions by 2032. How successful have we been since the report on proposals and policies 2, and is the scale of the proposed reductions achievable? Jenny Hogan said that we need to accelerate that and that technologies in that respect are available now. Would people like to comment on that?

**Jenny Hogan:** I will start. Indeed, I have more or less given our view on this, but, as I have said, those technologies are already available. We have various forms of renewable heat from different types of heat pump to biomass boilers, solar thermal systems and various district heating systems. Those technologies are available and being installed now.

We want the renewable heat incentive, which is the UK system that was mentioned earlier as having recently been reformed and extended, to be extended beyond 2021 to allow these technologies to continue to be installed. The focus seems to be mainly on energy efficiency until 2025; I absolutely recognise and do not dispute that energy efficiency is fundamental, but alongside that, renewable heat and other low-carbon heat solutions need to be rolled out sooner than 2025. I am not entirely clear why the draft plan and strategy has been set out in that way.

However, I welcome the consultation on local heat strategies, to which we will certainly be responding. Broadly speaking, I think that the public sector taking leadership in that area will be fundamental, and we would like to see more detail on how the public sector and local authorities can lead on renewable and low-carbon heat solutions.

**Christine MacKenzie:** We obviously welcome the Scottish Government's decision to designate energy efficiency as a national infrastructure priority. It is good to have improvements in the energy efficiency of housing stock alongside moves to decarbonise heat.

District heating has been explored a lot. SSE has done a lot of district heating UK-wide, and one of the lessons that we learned from our Wyndford

estate in Maryhill compared with some of our London projects is that real incentives at the level of building planning standards help to incentivise the market. We will submit to the consultation in more detail, but incentivising the private sector in Scotland with regard to district heating would make a big difference. A presumption in favour of district heating or perhaps a code of conduct or a body to oversee it in Scotland would be a good way forward.

One of the key issues that we have experienced with district heating is that it is important to get the infrastructure in place before worrying about what the fuel for it might be. It might start as a fossil-fuel system, but if it is in place, it can be switched over to a carbon-free source. It might not all come at once, but the idea would be to incentivise the initial installation of the district heating. Our Wyndford project was a retrofit, but most district heating is happening in new builds, and the regulations at the beginning of the process are critical in that respect.

**Lindsay McQuade:** Picking up on energy efficiency, I highlight the on-going consultation with BEIS on energy efficiency and the mechanisms to support it. When that concludes, we will be able to understand how Scotland will deal with its energy efficiency mechanisms, and we look forward to engaging with the Scottish Government on that issue, too. If Scotland has responsibility for its own budget to manage energy efficiency schemes, we can address issues that affect Scotland-based consumers and target schemes where they are needed.

One of our asks is for the development of an energy efficiency market for those services. With existing schemes such as the energy company obligation, which is an obligation on retail suppliers to our consumers, the providers of energy efficiency mechanisms understand that that is an obligation on us that we must deliver against. That does not necessarily result in the most competitive of markets, and a clearer market mechanism would benefit the consumer in the long run and ensure that the budget that the Scottish Government will be given can be put to best use and targeted where it is most required.

10:30

**Professor Haszeldine:** Going back to Andy Wightman's original question whether we can deliver on the target, I think that that stands or falls on heat delivery and how we do that. We are locked into a conversation about renewable heat and warm-water delivery systems, but I suspect that that will be really expensive on a whole-system basis. Part of the strength of the TIMES modelling is that it includes the true infrastructure costs for delivering that heat system to lots of

urban areas. It is easy to talk about individual projects and fitting local heat systems in new build; all that is fine and good, and we should consider that—and we should also of course consider improving efficiency in the existing housing stock—but the graph of heat delivery on page 22 of the energy strategy shows that, in winter, the heat delivery is equivalent to an extra 10GW to 15GW during the day and night. It is hard to imagine delivering that through renewable energy.

We therefore have to decide how we are going to deliver our heat. Will that happen by somehow building vast amounts of extra renewable energy? That would then reopen the conversation about how we back up that delivery when there are lulls in renewables. We have heard about an interconnector of 3GW or 4GW, but we would need another three or four of those interconnectors—even presupposing that we could buy the power from England during power shortages. We also need to consider whether we want to go into an alternative energy vector such as hydrogen, which we might discuss later.

It would be premature to decide now whether we deliver the heat through renewables or through a different low-carbon vector such as hydrogen. That is a very big decision. The climate plan and the energy plan talk about the potentials, but at this point we have not done enough analysis to make a final decision on that. Clearly, it is potentially possible to deliver the hydrogen system through the existing methane gas network, and it would mean that we would gain the benefit of several billions of pounds' worth of existing pipework, as we would be replacing one gas with a different gas. That would make conversion to a low-carbon heat delivery system much easier and more possible. The relevant organisation to take evidence from on that issue would be Scotland Gas Networks, which is just starting to analyse that. I am worried that we are being put in the position of trying to choose too early before we have looked at the whole-system costs and done a true analysis of what the alternatives for heat delivery really are.

**The Convener:** Jenny Hogan wants to come back in briefly.

**Jenny Hogan:** I have just a couple of points, the first of which is on business rates. District heating schemes are in effect penalised because of the way in which business rates are calculated, and we have asked the Scottish Government to reassess the methodology used for district heating schemes and ensure that it is fair and reflective. The same applies to on-site generation, which includes, for example, distilleries using their heat to generate energy. The system needs to be reviewed to ensure that it is fair and proportionate and helps to reduce costs.

On the issue of costs, district heating schemes are, as Christine MacKenzie has highlighted, already being delivered. We are looking at various types of technology with regard to renewables supply. Heat pumps and biomass are not variable technologies, but we recognise that they are still at a relatively early stage and are being developed in other countries as well as here, to some extent. There is a huge amount of potential. Electrification is part of the solution, but the key is having a mix and looking at different options. Hydrogen might well be part of the mix further down the line. It, too, is still at an early stage, and we would also welcome innovation and pilots in that area.

We need a variety of heat supply but renewables will have a key role to play, because we need to cut carbon. I agree with Christine MacKenzie about ensuring that the initial infrastructure is there. Fairly soon, we will have to ensure that it can switch to renewables or another form of very-low-carbon heat supply.

**Jackie Baillie (Dumbarton) (Lab):** I was fascinated by what Stuart Haszeldine just described to us. Do you have a sense that the Scottish Government is keeping a wide approach to testing different options or is it narrowing down to a particular route?

**Professor Haszeldine:** My conversations with civil servants in the Scottish Government suggest that there is a very strong interest in taking the wide approach. I would strongly advise the political masters to listen carefully to what the civil servants have to say about further analysis of the options. We need to discriminate between renewably generated heat and low-carbon heat. That is a really big decision that is not within the view or remit of any of the four witnesses here—it is a national decision. We need to take that decision bearing in mind that we are at the frontier of innovation in respect of how we go down the low-carbon route for Scotland as a country, or as a large region of the UK—whichever way you prefer to look at it. What we do will be relevant for us and our geography.

There are big possibilities for co-benefits for hydrogen, which are not included in the TIMES model, because the model cannot do everything. By that I mean, if we go down the hydrogen route for heating and make hydrogen available as an energy vector in Scotland, that opens up the possibility of fuel cells for vehicles in fleet transport—big trucks and buses—as well as for domestic transport for individual cities. It is not a certainty that we should invest everything in electric cars, for example, because hydrogen technology exists in other countries that is perhaps five or 10 years behind in terms of commercialisation, but we are taking decisions that will set a trajectory for Scotland for maybe 50

or 100 years. We should not be rushing to make decisions without a true analysis of the evidence.

If we want to supply hydrogen at national scale, Scotland is uniquely well positioned to do so, because we can manufacture hydrogen by splitting methane gas—that is a well established process that can be bought in. If we do that, we need to take away the carbon dioxide and store it. We could do that and create a carbon dioxide storage industry because through the Crown Estate settlement we now own the pore space offshore. Andy Wightman might know about that. We can try to use our energy strategy to create new profitable offshore businesses. We are not just talking about one small sector—there are ramifications throughout the industry.

We can also generate hydrogen from splitting coal in a coal chemical plant, with zero emissions. That process was invented and perfected in Scotland and is in daily use in parts of North America, to generate gas from coal. In the fullness of time, as renewables become cheaper, we can replace fossil fuel generating hydrogen sources with renewables generation, or have dispersed renewable generation of hydrogen around Scotland.

There is a completely alternative vision that includes fossil fuels and renewables—because renewables have a key place in our future—and that can provide us with much greater resilience and flexibility than we would have if we were to rely on an all-electric future.

**Jackie Baillie:** That is fascinating. I will go back to my planned questions—I had to divert for a minute there, convener.

In the past, there has been an alphabet soup of energy efficiency programmes. ECO—the energy company obligation—has been mentioned. We have had HEEPS, or the home energy efficiency programmes for Scotland; and now we have Scotland's energy efficiency programme, or SEEP. What is the difference, aside from the variation in the alphabet? Are such programmes the right approach? What else could we do?

**The Convener:** Who would like to take the alphabet question?

**Lindsay McQuade:** I sympathise with Jackie Baillie with regard to the confusion that the multitude of acronyms can cause. We would like greater consistency in how energy efficiency is approached, but it is not an easy issue to solve. We would also like more clarity around the definition of fuel poverty in order to ensure that help is directed where it is most needed. The setting up of the mechanisms to which Jackie Baillie referred does not necessarily mean that funding is directed to consumers who require assistance with their energy consumption. There is

an on-going review of the definition of fuel poverty, and we would like to see conclusions from that so that we can work towards tackling the issue.

I mentioned earlier that the Scottish Government now has control through its own energy efficiency mechanism. I represent a national supplier that serves consumers across the United Kingdom: we would like some consistency between the energy efficiency mechanisms that will operate in England and Wales and those in Scotland so that we can deliver best value for our consumers and use the budgets that are associated with energy efficiency most effectively.

**Professor Haszeldine:** I will not give a detailed answer on the subject; I simply say that energy efficiency is a key metric of decarbonisation of the economy.

Recent global analyses show that how efficient and low carbon a country can make its energy system is critical to arriving at net zero in 2032, and at a staging point along the way in 2020. I do not really mind how that is delivered, or which bit of the alphabet delivers it, but we should be careful. The green deal—or whatever it was called—in England was unsuccessful because it attempted to deliver efficiency through a totally uncompetitive pricing mechanism: a house owner could borrow money to make energy efficiency alterations at a much lower cost than they could when borrowing through the so-called help from the Government. In contrast, the Scottish system provided much more direct price support and help for home owners or dwellers, so it worked much better. We have a good track record in that regard. It is a long-term proposition—over 10 or 20 years—to produce much greater efficiency in our housing and in our transport, and gradually in our industries and businesses as well.

**Richard Leonard:** I come back to the domestic heating market. Two of the most valued qualities in politics are honesty and credibility. One of the proposals in the Scottish Government's plan and strategy is that we will switch from our current 80 per cent reliance on gas for domestic heating to 80 per cent reliance on low-carbon technologies in 15 years. As I look around, however, I see that gas smart meters and gas boilers are still being installed in houses, and the gas network is still being improved and invested in. How are we going to go from 80 per cent reliance on gas to 80 per cent reliance on low-carbon technologies in just 15 years? I am asking all of you.

10:45

**Professor Haszeldine:** I will go first this time. It is clear that that will be an extremely difficult thing to do. Part of it is about demand reduction, in

which we have already had success. Since about 2005, we have achieved a 15 per cent reduction in demand, partly through use of more efficient appliances and partly through insulation and greater energy efficiency of houses. We can anticipate further demand reduction and behaviour change of 10 per cent or more, which will be of some help. That will involve low-cost fitting of houses and an education programme. However, we are talking about limited gain.

If we were to go for a low-carbon option that includes hydrogen, we could hit that target in 15 years, but it is quite an ambitious target. However, there is no harm in being ambitious, because it stretches people. Through ambition, the cost of renewables has plummeted and the rate of delivery of renewables has increased. As I said at the start of the meeting, high ambition serves as a good pull.

I do not know whether it will be possible to build the necessary renewable electricity infrastructure in that timescale, which will involve identifying sites and constructing equipment. We must remember that, to achieve such change, we will need to have 10GW to 15GW of actual supply. We will need to have 45GW of renewables capacity to deliver that, and I do not know whether anyone in the delivery companies has any idea how they are going to do that.

If I had to make the decision, I would say that we have to have a moonshot project on converting the gas network to hydrogen. We could buy in some hydrogen generation equipment from the market and have it built within three to four years. We could reopen the feeder 10 pipeline from central Scotland to St Fergus to take away the CO<sub>2</sub> that is produced in generating that hydrogen and allow it to be disposed of offshore, thus enabling the low-carbon ambition to be achieved. We could do that by 2020. The Government's ambition could be delivered in 15 years, but we would have to have a strong indication that that was the direction that we were going to go in.

**Jenny Hogan:** I echo Mr Leonard's incredulation—if that is the right word. It is a hugely stretching ambition. However, I agree with Stuart Haszeldine; we welcome that ambition. It is a good place to start.

It is worth highlighting that it is quite hard to see from the draft plan and the draft strategy what the impact of each policy will be. For example, we do not know by how much the planned energy efficiency measures would bring down the actual heat supply that would be required, how much of a role electrification is likely to play and what that would mean for what is left over.

As far as the types of thing that will need to come into play are concerned, we have talked

about district heating. That will need regulation as soon as possible. Business rates will be key to that. There is still a huge amount of improvement that we can make with regard to building standards. The CCP mentions a bioenergy action plan consultation, which will take place once the CCP has been finalised. What the action plan says will be crucial to how great a role biomass can play.

The planning system will have a great role to play, too. Some quite transformative changes have been made through the London plan: we need to consider how we can learn from such examples. Continuation of funding will also be important—the renewable energy investment fund is mentioned in the CCP, along with other funding schemes.

We are expecting the UK's emissions reduction plan to be published some time in the spring. The UK has a long way to go on heat and transport, and there is not yet much sign of how it is going to make great changes, other than through continuation of the renewable heat incentive. If hydrogen is to succeed, it will need to be adopted on a system-wide basis across the UK. The UK plan might give us some clues about what the UK is going to do and how Scotland can link up with that.

I mentioned public sector leadership, which I think will be crucial. We need to think about what more the public sector can do to champion and show the way for renewable and low-carbon heat, in particular, and how it can help to drive forward that market. I think that that is enough for now.

**Professor Haszeldine:** I want to come back on that point. What we have just heard is that we really need to do the arithmetic on the feasibility of delivery of all that. There are conversations about the various policies, strategies, plans and so on, but it comes back to this point: if, as a part or region of the UK, we want to decarbonise heat through renewable generation, we need to build an immense amount of renewable electricity generation to do so. The arithmetic on that does not stack up, in my view. I would welcome the challenge, but I would like to see some arithmetic on delivery.

Perhaps we are just not prepared for that, and we should send in some extra information afterwards. That is fine. It does sound as though neither of us has a clear answer. We have worked on hydrogen delivery a little bit, and we will happily send in information on that, but we have not worked through the renewable delivery option, so I cannot speak on that. I would welcome information on it.

**Richard Leonard:** Are Scottish Power and SSE actively considering district heating or hydrogen as an alternative fuel source?

**Christine MacKenzie:** As I said earlier, we already have quite a few district heating schemes in place across the UK. There is a pilot in Maryhill, at Wyndford.

The thing to remember is that we, as energy companies, are participants in a marketplace. We have a regulator and we have a Government that drive the direction of policy. Anything can be achieved if we have the right incentives and laws in place to make it happen. At the moment, we are at the thinking stage: where exactly should we be going? We are happy to participate, using our business expertise in SSE, in coming up with thoughts. Ultimately, however, we are a participant in a marketplace, and we must abide by the policy that is decided.

We are working where we can on pilot projects. We are working towards making district heating happen, together with housing associations, with a number of social housing providers, with the private sector down south and with the building industry. We are exploring a range of business options. As I said earlier, we welcome the fact that the Scottish Government has made it a priority.

**Lindsay McQuade:** I agree that the target is ambitious. The person at the end of this change in approach is the consumer. We all value the ability to heat our homes and to control that flexibly. The solution for decarbonisation of heat has to be something that the consumer is willing to adopt and accept. Aside from the arithmetic relating to what the optimal mix will be, there is a need to motivate people and to promote the change in consumer behaviour that we will need, so that people will willingly adopt lower-carbon forms of heat generation. That will, I hope, allow us to achieve the targets that have been set out.

I have spent 15 years with that ambition in mind—it does seem challenging. There are workshops and various pieces of analysis running; in fact, I believe that we will attend a workshop this Thursday to discuss renewable heat. We are keen to understand more about it, and to shape out where we can best use our expertise as an energy retailer to service the requirement.

**The Convener:** I thank all our witnesses for coming in today. I invite them to make further submissions in writing on any further points that they wish to make—perhaps on the last points that were made by Professor Haszeldine.

10:53

*Meeting suspended.*

10:59

*On resuming—*

**The Convener:** We recommence our meeting with our second panel of witnesses. I thank them for joining us to discuss the Scottish Government's climate change plan and energy strategy. They are: Nicola Pitts, the head of gas commercial frameworks for National Grid; Julian Leslie, the head of electricity network development at National Grid; Kersti Berge, partner for networks and the head of Ofgem in Scotland; and last, but not least, Andy Burgess, associate partner for energy systems integration at Ofgem.

Some of the witnesses were in the room for the previous evidence-taking session, so they heard at least some of the evidence from the previous witnesses. I am interested in their views on how the new plan relates to the previous one, how feasible and realistic the targets that are set out in it are and, perhaps most importantly, what new opportunities it presents for the Scottish Government to develop and move things forward within the current framework in Scotland.

**Nicola Pitts (National Grid):** I very much welcome the plan and strategy and the fact that a multistrand approach is being taken. The challenge that we all have is to determine the multiple levers that we can pull, not just the few. I also welcome the fact that the plan is positive about new technology. Over the next decade, we need to enter into a period of active experimentation—we have talked about some of the technologies at the committee—to make the necessary shift.

As came out in the previous witnesses' evidence, the challenge concerns how we decarbonise heat, particularly if we focus only on the household. How do we get the cost and convenience that makes it palatable for households to change in the necessary timescales? Our history of adoption—which I am happy to go into later, if you would like—has been particularly slow, so we might want to think of other options for how we decarbonise heat rather than simply focusing on the household.

**Kersti Berge (Office of Gas and Electricity Markets):** Likewise, we very much welcome the Scottish Government's plan and energy strategy. It is not for us to comment on the feasibility of the targets. The UK Government and the Scottish Government set them. We, as the regulator, and National Grid need to ensure that the market arrangements and the arrangements that cover network investments are fit for purpose to enable that strategy. We need to be clear about our role in the matter. The Government sets the targets and holds the biggest policy levers to implement them.

**Andy Wightman:** Policy outcome 1 is to get the grid intensity down to below 50g of CO<sub>2</sub> per kilowatt hour. Given that the Department of Energy and Climate Change's best-case scenario, which was published early last year, suggests that we might get to 100g by 2030, is 50g too ambitious? How do we assess the extent to which we are getting towards 50g when we have a GB-wide grid?

**Julian Leslie (National Grid):** One of my observations on the plan is that we need to remember that it is a GB network and grid. Therefore, many of the services and products that are covered in the plan are also available across the rest of GB.

Obviously, we can measure the energy consumption within Scotland and compare that to energy production here. The two are misaligned: power is consumed based on consumer behaviour, whereas the production of power goes with the weather. We can do the trade-off equation and ask how many terawatt hours of energy Scotland has consumed and how many it has delivered through renewables. For the bulk of the time, a lot of the wind power—and it is wind, in Scotland—is going south to England and Wales. On days like today, and certainly on days such as those that we had last summer, Scotland imports a lot of energy from England and Wales, so the energy goes the other way, to make up for the shortfall.

The way in which you make your carbon assessment depends on the benchmark that you use to consider energy consumption. Are you looking at the time-of-use carbon intensity, which will vary through the year, or are you just going to compare the total volume of energy consumed against the total volume of energy generated, even though the two might not match? You need to be very clear about the basis on which the 50g will be calculated.

**Andy Wightman:** Are you saying, in other words, that it is a legitimate and valid target, but it is not clear how our success in meeting it will be calculated?

**Julian Leslie:** Yes. You can calculate it in one way and come up with very low carbon intensity. If you calculate it the other way, and consider the source of the energy for every kilowatt hour consumed throughout the year, your intensity will be much higher.

**Andy Wightman:** But you are saying that it is possible to do that.

**Julian Leslie:** Yes.

**Andy Wightman:** Okay. That addresses my question, thank you.

**Gillian Martin:** Mr Leslie, last week, Peterhead power station, in the north-east, was penalised with higher costs in the capacity market auction because of its geographical location. If we have a GB-wide grid, how is it justifiable for Peterhead—a GB-based power station and the only non-nuclear power station in Scotland producing into the grid—to be penalised in that way?

**Julian Leslie:** It is a GB-wide market. The capacity auction allows all generators that meet the criteria to submit their price into the auction. We then run the process and generators are selected.

In relation to meeting network security, Peterhead is an option—it is obviously a location option in Scotland. However, we can meet grid security without that power station, from a network security point of view.

The capacity mechanism is only one contract of many—of course, there is commercially sensitive information, which we cannot divulge here. Peterhead could be successful on a range of other services that it provides to the grid.

**Gillian Martin:** Do you agree that the security of plants such as Peterhead might be threatened if they cannot compete because, due to their geographical location, they are penalised by high transmission costs?

**Julian Leslie:** Peterhead is not being penalised. There is a locational charging regime in GB, and there are a lot of assets between Peterhead and where the most demand is consumed; therefore, a lot of network investment happens on the back of that. Locational charging is something that we have in the UK. All the generators are equally subject to that, and it is a competitive commercial decision for SSE as to how it bids and how it plays in the market.

**John Mason:** During the earlier part of the meeting we had a discussion about installed renewable capacity. I questioned the witnesses about the various figures that have been thrown around, and I want to question you, too.

The energy strategy indicates that between 11GW and 17GW of installed renewable capacity will be required by 2030. The UK Committee on Climate Change has said that a significant increase in the rate of renewable energy installation will be required. It estimates that by 2020 we will need

“between 14 and 16 GW of installed renewable capacity”,  
and that

“the average rate of deployment ... would need to increase significantly to 1.3 GW per year.”

Do you recognise those figures? I do not know whether you can comment on them.

**Kersti Berge:** I might hand over to National Grid on that. National Grid forecasts a range of scenarios for how the energy system will develop, and many parties—industry, transmission companies and Ofgem—use the scenarios. The question might best be answered in the context of that scenario work.

**Julian Leslie:** National Grid produces four energy scenarios each year. In one, we are on track to meet the UK Government's target, GB-wide, delivering 34 per cent of electricity from renewables by 2020.

We also produce scenarios for beyond 2020. In one, we meet the environmental targets, but maybe one or two years late—that is what we call the “slow progression scenario”. In another, the “no progression scenario”, we focus on conventional power plants and move away from the renewable focus. Then we have the “consumer power scenario”, which is where we have a booming economy and people elect to buy renewable goods and products and switch to renewable energy because they can afford to do so and it is the right thing to do. Those scenarios allow us to create a credible envelope in which to plan and operate our network, going all the way out to the mid-2030s in detail and then going out to 2050 at a higher level. We have a broad range of scenarios that we are hoping to head into.

The National Grid operates all the processes that sit behind that in terms of network investment. We use that range of credible scenarios in order to test what investment should be made and when; to make sure that we invest in and deliver the most efficient electricity network just in time to manage the constraints; and to ensure that we are ready to deliver the renewable objectives in the network.

Today, we are sat in Scotland with 11.5GW of total generation contracted, but that includes Peterhead and the two nuclear stations. There is another 5GW out there, which is consented, but it is not coming forward at this point because it does not have any form of renewables incentive, and there is another 6GW out there, which has a contract with the National Grid but has yet to go through the consenting process. That represents a pipeline of a further 11GW of generation that we have contact with and have a contract with. As and when the economic environment is in the right place, those projects are willing, able and ready to come forward to connect.

If that all came to fruition, it would bring total Scotland generation to about 22GW against a peak demand of 5.4GW for one half hour a year. We are already double the peak demand and there are projects out there that will take us to quadruple the peak demand in terms of installed generation from renewables.

**John Mason:** How does the relationship work between what you decide about where we are going over the next 10, 15 or 20 years or whatever it is and what the likes of SSE and Scottish Power and so on decide on when it comes to investing in other capacity? Is it purely through the contract mechanism? Is that how it all works?

**Julian Leslie:** Our scenarios are just a view of the future. They are not a plan; they are not a direction; they just give us the ability to understand the range of possible future outcomes. However, they are impacted hugely by policy and market conditions. That is where SSE and SP come in—they look at those market conditions, the technologies, the cost of those technologies and the policy direction. It is down to the developers to decide where and when to invest and in what technology.

**John Mason:** Would you say that they are guided by your view of future requirements, even though it is not a plan?

**Julian Leslie:** It would be one of their many, many inputs. They would look at the scenarios to get the National Grid's view about where things are going.

**Kersti Berge:** National Grid is the system operator. The parties that invest and build generation plant are private sector companies and they will make decisions based on the commercial viability of their plants. They make the decisions about what to invest in, be that thermal plant or renewable plant. There have been some changes in the energy market set-up recently. However, what is important is that there is somebody who provides some overview of plausible future scenarios that make assumptions about who is going to invest where and when, which is what Julian Leslie was talking about.

There is a bit of to-ing and fro-ing—the developers look at National Grid scenarios but fundamentally what they look at when they decide to invest is whether a plant is viable in light of future market conditions or any support there might be from Government and other sources.

**John Mason:** Does Ofgem comment on the companies' assumptions or decision making?

**Kersti Berge:** Not directly. Our role is manifold but primarily it is twofold. We need to ensure that there is competition in the parts of the market that are competitive—in the supply market and the generation market. We are also responsible for making sure that the network companies—in electricity, that means the transmission system operators and the companies that operate the smaller distribution network line—invest efficiently. To do that, they need to ask what the plausible scenarios are, what generation is going to be

developed and, in light of that, what kind of network they should build, and where.

The scenarios that Julian Leslie talked about help a range of market participants, including us, to understand what the future will look like. It is a consultative process, and there is a real challenge to what National Grid presents. The scenarios are often changed in light of challenge through the consultation process.

There is no central planning, but it is helpful if somebody provides a fairly authoritative view of a range of different possibilities for what the energy system might look like in the future.

11:15

**John Mason:** Okay. Thank you.

**Gil Paterson:** I have a question, which I asked in the previous evidence session, about the Scottish Government reaching its targets and the fact that subsidies have been taken away. Could the private sector bridge that gap and provide assistance?

I had a follow-up question for the folk on the previous panel that I did not get the opportunity to ask; I apologise for that and will now put it to this panel. If I could be sacked, I would probably get sacked for asking this. As capital is the issue, and as we are talking about big money right down the line, could there be a scheme for Governments to underwrite the capital?

**Kersti Berge:** That is very much a question for Governments. I suppose that underwriting capital is another form of support. We can have a range of support mechanisms, such as direct subsidies and the underwriting of capital costs.

As I said previously, decisions about climate change targets and the high-level policies to achieve them are very much matters for Governments. It is also for Governments to decide the extent to which they want to use subsidy tools—that is not really a matter for us to comment on.

**Gil Paterson:** If making up the difference that I referred to would be challenging for private industry, should we as a Parliament consider a request for support? If such support was available, would it make a difference?

**Nicola Pitts:** National Grid is also a public limited company, and the main thing that we and other businesses want is a stable investment climate and to be able to look ahead as far as possible at what Government policies might be, in order to look at different scenarios and work out their market dynamics. If Government policies are changing or there is wider economic disruption, that tends to delay or halt investment decisions. If

there was a stable economic climate and stable Government policy for far enough ahead, that would produce enough signals for business to make final investment decisions.

**Gil Paterson:** I do not know whether anyone read *The Herald* yesterday, which had a letter that said that

“renewable ‘technologies’ are adding to CO2 emissions, not reducing them.”

I will quote a slice from that interesting letter. It said:

“Almost all wind turbines are induction generators and, as the name suggests, induce relatively small electrical currents from the UK National Grid so that when the wind blows these currents are effectively ‘amplified’ and are added to the National Grid’s capacity. Unfortunately, because of the blustery nature of the wind, this ‘amplified electricity’ is of such poor quality the grid will collapse as it cannot handle more than 10 percent of this corrupting junk electricity at any moment in time.”

I see that you are all smiling. I had a wee laugh when I read the letter, too—my background suggests that it is a spoof letter or fake news. Will you clarify that point and put on record what you think?

**Julian Leslie:** The letter is spurious. The power that a wind turbine generates goes through a bunch of power electronics before it comes on to our network, so the power that we receive, whatever its source of generation, meets the required industry standards. Whatever happens in the turbine—it is true that the power is low grade—by the time the power meets the grid, it is of a high quality that meets the UK regulations on delivery.

On Christmas day, 47 per cent of the entire nation’s energy was supplied by renewable generation—that is the highest sustained level of renewable generation that we have ever had in the UK. To say that we can do no more than 10 per cent is just not true.

**Gil Paterson:** That is smashing—thanks.

**Gillian Martin:** We talked with the previous panel about carbon capture and storage, and I get the sense that we have a problem on our hands, given that the technology is not yet in a sufficiently developed state and the research funding was taken away about 18 months ago. I am just on the border with Peterhead and I know that my area was greatly affected by that. A lot of people in the area are keen to be at the forefront of the technology.

Given your expertise, will you say what other options will be available if the technology is not developed? It has been mentioned that CCS does not appear in the UK Government’s plans and strategy. What are the regulator and the system operator doing to facilitate the development of CCS technology, given that the TIMES model

came up with it and, as we heard with the previous panel, every scenario results in CCS being crucial to delivering the targets?

**Nicola Pitts:** The scenarios that Julian Leslie spoke about, which meet the 2050 carbon targets, have an element of carbon capture and storage. I am leading a project in National Grid that is looking at the future of gas transmission, and some of the medium and higher cases would need to have carbon capture and storage.

As I understand it, the elements that are needed for carbon capture and storage are all proven in themselves. What has not been proven is the end-to-end process, which we should test the viability of. The Energy Technologies Institute did research that said that, without carbon capture and storage, £30 billion to £40 billion would be added to the cost of meeting our carbon targets. That crops up in most studies. The question is how we test the viability and scalability of CCS—as a previous panel member mentioned—and at what levels.

There is interesting technology, which was mentioned earlier, that could convert Leeds into a hydrogen city, but it would require carbon capture and storage.

I return to my opening comments. Over the next decade, we—policy makers and the industry as a whole—should be looking forward to ways in which we can experiment with different technologies. That is what will take us forward.

**Gillian Martin:** Did we miss a trick by cancelling the project in Peterhead? It will take Government investment in research funding, particularly in the light of Brexit, to get us to where we want to be. As the system operator and the regulator, what message do you have for the two Governments about the investment in such technology that is needed to get us to where we want to be?

**Nicola Pitts:** The competition ended abruptly. To go back to my previous comments about investment certainty, it would take a signal from the Government for people to look at such a project as a serious option again.

**Gillian Martin:** Would you like that study to be brought back on board?

**Nicola Pitts:** Or for carbon capture and storage or reuse to be reconsidered.

**Andy Burgess (Office of Gas and Electricity Markets):** I have a broader point to make. We are agnostic on carbon capture and storage. Everything that we have heard suggests that it could be a game changer, but it is not certain when it could become viable and it is a question of exploring when that might be. It is important not to put all our eggs in one basket; we should plan for something that is uncertain. We have to plan for

uncertainty generally and explore different ways of doing things.

That is why we have recently been looking at electricity system flexibility, which is about how we can better use the energy that we have today through exploring storage and demand-side response—using energy at different times to even out the load across the system—as well as how technology can improve the management of networks and how the system can generally evolve through new forms of technology and new ways of doing things. That could include hydrogen and, in the future, CCS. It is important not to follow just one path but to allow for different possibilities. There are probably technological developments that we do not know about yet.

**Gillian Martin:** Sure. I get that, but the climate change plan, which used the TIMES model, specifically mentions that CCS is a vital part of a variety of solutions to carbon emissions.

**Ash Denham:** We know from the plan that decarbonising heat will be a significant part of achieving the goals that we want to achieve. We have a very large gas network set up. If we wanted to repurpose it—maybe for biomass or hydrogen—what would be the regulatory or system barriers to doing that?

**Nicola Pitts:** Fortuitously, at the local level, quite a large mains replacement programme has been going on, and transporting hydrogen at the local level is viable through the plastic pipe network. We are looking at the transmission system—the bulk transfer—and we are undertaking a project on what the impacts would be on our pipework, which tends to be steel, and our compressor network, which is the fleet that pushes the gas around the network.

As for the frameworks, we have the Gas Safety (Management) Regulations 1996, which cover gas quality. That sounds a little dull, but it is extremely important. It is about the composition of gas and it replicates what we found in the continental shelf when we transitioned to gas. That framework, which is operated under the Health and Safety Executive, has been amended over time to allow things such as biogases to come forward. There are also European standards that are very different from our own. A study is going on that is looking at whether we should move away from those gas quality standards to a wider specification, which would have advantages in allowing us to develop different technologies, or to something that would make it more attractive for people to bring different types of gases to Britain generally. That is one example of the frameworks that we would need.

If we went down the hydrogen route, we would need to think about how we changed over to that,

which we have talked about. We would probably need some form of carbon capture and storage regime to take the carbon from the area as well.

More generally, we are looking at whether we could deploy a product at the transmission level that is a smaller and more agile connection. We also need to think about how we change our frameworks and commercial regimes so that there is a quick connection in terms of not just the asset but the frameworks that go with it.

We can do lots of things. I talked before about our experimenting with the technologies. We also need to look at the frameworks to ensure that they will be ready in time for those technologies to come forward.

11:30

**Kersti Berge:** The question is very important—it is the big question for Scotland. I think that Ash Denham's point is that Scotland has mostly decarbonised electricity supply, but how the heat will be decarbonised is the big question and uncertainty.

We are starting our strategy work for the next set of price controls. For the monopoly networks, we set price controls, which currently run for eight years. For gas, the next period will start in 2021-22. Alongside the industry, we are starting to think about what the network might look like.

With heat, we have a range of options. We might have local district heating systems, the gas network might be as it is or we might have the gas network with cleaner gas, such as biogas or a significant amount of hydrogen. Nobody knows yet exactly what the system will look like. That is why it is important that parties, including the network companies, innovate to see what works and what does not, to put it simply. Nicola Pitts talked through some examples of that.

People talk a lot about hydrogen. How much hydrogen can we safely put into the network? There are projects to trial that, and the one in Leeds is probably the most famous. As the monopoly regulator, we have been actively encouraging the companies to trial and innovate. Monopoly companies are not famed for being innovators because, unlike companies in the market sector, they cannot steal other people's customers. That is a bit unfair on the companies, so we have put in place incentives for them to innovate. We have done that partly by making the price control period longer, so that they can get some returns for their innovation and—importantly—through our network innovation competition, which hands out about £70 million a year to get the companies to innovate.

Trialling hydrogen on the gas network is one example of innovation. Another example is work to see whether we can manage with slightly lower gas quality standards. That might sound a bit scary but, as I am sure we will come on to, it is important that we get a balance between what is cost-effective and might work and achieving the environmental targets. Through the gas quality issue, we could bring down costs for consumers and improve the environmental quality of the gas that goes through the pipes.

**Nicola Pitts:** Another technology, which has probably been trialled a bit more in Europe, is power to gas. In essence, that soaks up excess renewable energy to create hydrogen that can be injected into the gas pipes. If that was done at scale, we could almost blend away some of the gas quality issues. We are considering whether we could take forward such a project under one of the network competitions.

To go back to frameworks, that starts to bring out issues about how the gas and electricity frameworks perhaps need to come together and operate in tandem at wholesale level. As we see more gas-fired generation, we will have opportunities to work the gas and electricity systems together to create the right outcome for consumers on energy as a whole.

**Ash Denham:** Obviously, if we want to stay on target, we need to decarbonise heat significantly in the next 15 years. Can you set out, for a layperson to understand, how easy it would be to start injecting hydrogen into the gas network now?

**Nicola Pitts:** We would need to go through the process of looking at gas quality to make sure that it was safe, but there is a project already under way to look at that. We would then need some primary legislation to change the gas safety management regulations.

**Ash Denham:** Do you think that that is feasible within the timeframe?

**Nicola Pitts:** Yes.

**Jackie Baillie:** I just have a small point, which I think that Kersti Berge invited. We have opportunities for lots of different new technologies, some of which we are not even aware of, but we have left the cost to the consumer out of the discussion. Whose role is it to say, "This is going to be too expensive and there is a cut-off point at which we have to balance what we do in the future"? Is that Ofgem's role?

**Kersti Berge:** Shall I go first? Jackie Baillie is dead right—that is hugely important and, yes, I gave her a bit of an opening. It is all about providing things for consumers, who care about environmental targets but also about costs.

Whose responsibility is it? The Scottish and UK Governments set the targets, and they control the very big policy instruments to meet those targets. They decide how much subsidy is provided for different types of renewable regeneration and nuclear plant—that is very much a Government decision that we do not have a part in.

As the regulator, Ofgem is responsible for part of the cost chain. Our role is to make sure that the market arrangements facilitate investment, the use of the network and the cost of the network in the most efficient way. We need to work out what works and what future scenarios look like.

Our big focus is on having a level playing field in relation to anything that happens on the network and how the network facilitates connection of different generation types. That is because we, the Government and other parties get lobbied by lots of different parties who want support for their technology, whether that is nuclear, marine, CCS or wind. What is helpful for consumers—I am simplifying this somewhat—is that the most efficient technology that is needed to manage the transition to the new system wins out. Our role, alongside the parties that build the network, is to ensure access to the network and to keep the costs of the network down.

**The Convener:** We will move on to a question from Richard Leonard.

**Richard Leonard:** I have a broader question, but first I come back to Peterhead. Energy supply is a strategic part of any economy, and new fossil-fuel power stations are being built in other parts of Britain—that has been mentioned a few times. Presumably those are gas-fired power stations, predominantly in England. I understand from this morning's papers that SSE is talking about closing down Peterhead. Where is the strategic sense in closing down an already existing gas-fired power station and then building new ones elsewhere in the grid? I do not understand what sense—strategically, from a national point of view—that makes.

**Julian Leslie:** From a UK point of view, the Government—BEIS—sets the capacity mechanism and strategy for what to purchase through the auction. Obviously, that takes us back to consumer bills. The auction is running and delivering secure sources of energy at a very low cost. However, that means that even larger transmission connected new generation within England and Wales is not winning contracts—it affects not just larger generation in Scotland but larger generation across England and Wales.

The strategy favours existing diesel and gas reciprocating engines, which are already built in a lot of cases. They support hospitals and industries as their back-up generation and provide those

industries and hospitals with another revenue stream from an already existing asset. It is also true that the strategy is triggering some new-build small gas reciprocating engines and small diesel engines as well. Ultimately, that combines together to give the circa 50GW of capacity that we believe, working with the Government, is the right level of capacity to ensure that we have a safe and secure energy network within GB.

**Richard Leonard:** In times gone by—I am not harking back all that far—there was a regional dimension to the electricity market. Back in the days of public ownership, we had the North of Scotland Hydro-Electric Board, the South of Scotland Electricity Board and the regional companies across England, for example. Do you see any purpose in having a regional strategic dimension to the supply of electricity?

**Julian Leslie:** Part of my role is to ensure that we have a safe and secure network that can deliver the energy that is required under any circumstance. We have just done a huge piece of work, working very closely with the Scottish transmission owners, to look at a post-Hunterston, post-Torness, post-Peterhead world and ask whether the existing network plus the reinforcements that are coming will be able to meet the energy demands in no-wind, high-wind, low-water and high-water scenarios, and the conclusion to that work was that they will.

I return to my point that you are part of an integrated GB transmission network and, therefore, the energy that you need in Scotland can be supplied as part of a GB network.

**Richard Leonard:** Is that report available? Has it been published?

**Julian Leslie:** It was an action that we took from the Scottish energy advisory board. We will report back to it on 16 February and a series of publications will follow. However, two documents are in the public domain. One is the electricity 10-year statement that was published on 30 November, and the other, which was published last Monday, is the network optioneering assessment, which looks at the range of future scenarios that we have talked about and overlays the network capability that is required for those.

Because we have the electricity 10-year statement, we can see where the pinch points are. The network optioneering assessment then details the associated investment that matches that future range of scenarios and—to go back to the consumer point of view—considers the most economic way that we can invest with the transmission companies to ensure that we have a network that is fit for the future while ensuring that we meet all the requirements in relation to demand.

In Scotland, you have a 5.5GW demand peak, and that is for one half hour each year. By the time we get to the end of this year, once the western HVDC link is built, you will have a 6GW import capacity. For that one half hour, therefore, we already have a 500MW surplus, plus you will always have some hydro and there will always be a bit of wind blowing somewhere, so there is more than enough margin to meet your future demands in Scotland without any form of generation.

**Richard Leonard:** The sense that I am getting from this discussion and the evidence that we have heard from previous witnesses is that Scotland is moving to a position where it will be considerably dependent on renewables—in the post-Torness, post-Hunterston phase, it will presumably be exclusively dependent on renewables—but it will also rely on nuclear power and gas-fired generation from other parts of the GB market. Is that how the National Grid sees it?

**Julian Leslie:** It is a GB market. The economic forces, the frameworks and the rules determine the most economic solution to ensure that we meet GB energy needs, and we are investing in our network to ensure that the future network is capable of doing that as the generation sources move. That is absolutely done on a GB-wide basis, and your needs in Scotland will be met.

You can export up to 6GW, which you will need to do on a very windy day, because you will not have the demand but you will have all the generation. On a day when the wind stops blowing, you can import energy from England and Wales, in whatever form. With future and growing interconnection with Europe, we will also have access to other renewable sources across Europe, which will then flow into England and meet that national demand.

**Bill Bowman:** I will ask the question that I asked the previous panel, although I think that you have already touched on some parts of it. The Scottish Government's draft energy strategy states:

"in the absence of adequate storage capacity, thermal electricity generation is required to provide important base-load capacity and support the resilience of the electricity system."

Is new thermal base-load capacity necessary or desirable? How might it be built, given the electricity industry's current reluctance to invest in new plant? At least three witnesses on the previous panel pointed to National Grid and said that the way that you cost it means that it does not make sense for them to do that. This might also relate to Gillian Martin's point about the geographic basis of charging. Is this something that you need to look at again?

11:45

**Julian Leslie:** We firmly believe in locational charges across GB. However, we also believe that, with the rapid change in the nature of generation in the network and how it is now used, and the move to decentralise generation, it is now time to start work on looking at a holistic charging review to work out the most economic and cost-effective way to charge for access to the transmission network, and to try to roll in access to the distribution network.

There are two networks. The transmission network is like the motorway, and the distribution network is like our A and B roads. There is a discrepancy in relation to the different charges across those two networks, so we are embarking on a piece of work in which we will look at that holistic charging space and find the right way to charge for access to networks across GB.

**Bill Bowman:** Are you saying that the Scottish Government's statement that thermal generation is needed to maintain the resilience of the system is not correct? You think that resilience can be maintained through the interconnector.

**Julian Leslie:** Yes. The work that we have just completed and on which we will report to the Scottish energy advisory board in a few weeks demonstrates that, with the right network investment, which we have time to do over the next 10 years or so, we can maintain the 5.5GW of demand security that is required in Scotland.

**Gil Paterson:** My question is about the Scottish Government getting involved in forming a company to deliver some of the services. Is there any legal impediment or regulatory requirement that would cause the Government to fail in its endeavours? Would there be any risks to and liabilities for the Scottish Government if it became involved in forming such a company for the energy market?

**Kersti Berge:** We will speak to the Scottish Government about what its energy company would do. There is a range of companies already. Some local authorities have formed their own energy companies and we already work with them, so we will work with the Scottish Government on its plans.

I want to take a step back. As well as seeing innovation in technology, we are also seeing a lot of innovation in business models as the energy system changes. There is a desire for local energy companies and for different kinds of energy companies. We are keen to work with parties who are interested in that area because we do not have all the best ideas—we are rather narrow-thinking regulators—and we want to work effectively with innovators to make sure that the companies that come forward can bring

consumers new benefits, whether those are environmental benefits or lower costs. At the same time, we want to make sure that consumers are protected and that they know what they are buying into when they get their supply from a particular company.

We have not gone into a lot of detail with the Scottish Government yet. We have some models that are similar to what it is proposing, and we are keen to work with the Government on the matter.

We recently started a couple of initiatives, one of which is the innovation link, which is a website that offers help in understanding the regulatory implications to those who are thinking of setting up a new kind of business. The energy market is not that simple and we do not want the rules, which are all there for good reasons, to be a barrier to the entry of new business models.

We also have what we call a regulatory sandbox, which allows people to trial a new business model on a small scale to see how it works for them.

We welcome the initiative and will work with the Scottish Government to understand exactly what it wants to do with the company and to make sure that, if it is a good thing for consumers, there are no barriers in place to prevent it from doing the right thing.

**Gil Paterson:** Thank you.

**The Convener:** We will move on. Andy Wightman has another question.

**Andy Wightman:** There is a lot of interest in developing local energy networks, with some commentators suggesting that they are a key part of the way forward.

We heard from Kersti Berge that there is a willingness to consider the regulatory side and to help people to develop business models. We have built up a GB grid model, so might developing local systems be problematic? Julian Leslie is shaking his head.

**Julian Leslie:** There are already many examples of local solutions either in place or in development. There are many regional constraints on our network that we can manage in traditional ways by contracting with the transmission-based generation. However, that would not be efficient. Working with the relevant local distribution network operators, we can install smart black boxes on the network, monitoring system conditions and taking the right actions, based on a set of commercial rules that involve all the local generation plus the larger transmission-based generation.

There are pockets of great work by the distribution companies. The Northern Isles New Energy Solutions project on Shetland has gone for

a fully integrated network covering diesel generation, battery storage, consumer behaviour and consumer devices in the home, all combined with renewable energy. As it involves an island-based community, it is quite straightforward to isolate that network and get a really good working example of how a smart, integrated energy system can work.

In UK Power Networks in the south—in some of the London projects—we are seeing great innovation that is bringing together energy production with energy consumption and smart devices that work in conjunction with the network. We will see more and more of that.

National Grid and UK Power Networks have just won some network innovation funding for a project that will look at the whole-system transmission distribution interface to ensure that we operate the network on a whole-system basis, rather than thinking just about transmission, with distribution doing its own thing. Bringing those two things together is essential as we move to a decentralised energy network. Scotland has been leading the way on that; the distributed generation in Scotland has always been head and shoulders above the approach in England and Wales. Our big push for solar in the past 12 months means that the south now has more embedded distributed generation than Scotland, but the issues are the same. We have worked very closely with Scottish Power distribution and SSE distribution in Scotland to find innovative solutions.

As technology progresses, and as we gain confidence that the black boxes work in the right way, we are on the cusp of seeing a big-scale roll-out of such network innovations. It is a lot cheaper to install a black box for the few days when the wind is very high and the demand is very low, so that the right action is taken, than it is to build new transmission that will get used only for a few hours or a few days a year. It is an efficient way to maximise capacity on the network.

**Andy Wightman:** The short answer, therefore, is that you do not see any significant barriers to developing a decentralised energy supply and consumption system from a regulatory or an infrastructure point of view.

**Andy Burgess:** From the regulatory perspective, we welcome such a system. We agree that the dividing line between the bigger and smaller networks is merging. There are more ways to make better use of energy; there are lots of opportunities at a local level.

We are also looking at the implications for funding the long-term costs of the infrastructure. Most of the network infrastructure was built years ago—the payback period is usually about 40 years. We do not want to stifle any local

developments, but we want to make sure that the costs of running the networks and the fixed costs are shared in a fair way among consumers generally. Given that we have a primary duty to protect consumers, we would not want to see an increasingly small number of consumers who are dependent on the main infrastructure funding it all, while more consumers go off-grid and, in effect, get a free ride, despite the fact that the infrastructure is there as a back-up. The costs have to be shared fairly; we are looking at that issue. We welcome local energy initiatives and the fact that more are happening locally, but we need to make sure that consumers as a whole are treated fairly and that the costs are apportioned in the right way.

**Andy Wightman:** Thank you.

**The Convener:** I thank all our witnesses. If there are any further points that you want to submit in writing to the committee, we will be glad to receive them. We move into private session.

11:54

*Meeting continued in private until 12:23.*



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