OFFICIAL REPORT
AITHISG OIFIGEIL

Net Zero, Energy and Transport Committee

Tuesday 21 March 2023

Session 6

The Scottish Parliament
Pàrlamaid na h-Alba

Tuesday 21 March 2023

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NET ZERO, ENERGY AND TRANSPORT COMMITTEE

10th Meeting 2023, Session 6

CONVENER

*Edward Mountain (Highlands and Islands) (Con)

DEPUTY CONVENER

*Fiona Hyslop (Linlithgow) (SNP)

COMMITTEE MEMBERS

*Jackie Dunbar (Aberdeen Donside) (SNP)
*Liam Kerr (North East Scotland) (Con)
*Monica Lennon (Central Scotland) (Lab)
Ash Regan (Edinburgh Eastern) (SNP)
*Mark Ruskell (Mid Scotland and Fife) (Green)

*attended

THE FOLLOWING ALSO PARTICIPATED:

Professor Stuart Haszeldine (University of Edinburgh)
Mark Hull (Community Energy Scotland)
Clare Lavelle (Arup)
Scott Mathieson (Scottish Power Energy Networks)
Aileen McLeod (SSEN Transmission)
Tom Quinn (Offshore Renewable Energy Catapult)
Emily Rice (Solar Energy UK)
Collette Stevenson (East Kilbride) (SNP) (Committee Substitute)
Morag Watson (Scottish Renewables)

CLERK TO THE COMMITTEE

Peter McGrath

LOCATION

The Mary Fairfax Somerville Room (CR2)

Scottish Parliament

Net Zero, Energy and Transport Committee

Tuesday 21 March 2023

[The Convener opened the meeting at 09:41]

Decision on Taking Business in Private

The Convener (Edward Mountain): Good morning, and welcome to the 10th meeting in 2023 of the Net Zero, Energy and Transport Committee. We have apologies from Ash Regan. I welcome Collette Stevenson, who is joining us as a substitute member.

The first item on the agenda is to decide whether to take items 5 and 6 in private. Under item 5, we will consider evidence that we will hear today as part of our inquiry into Scotland's electricity infrastructure. Under item 6, we will consider correspondence relating to appointments to the board of Environmental Standards Scotland. Do members agree to take those items in private?

Members *indicated agreement.*

Electricity Infrastructure Inquiry

09:42

The Convener: The next item on our agenda is an evidence session as part of our inquiry into Scotland's electricity infrastructure and whether it is an inhibitor or enabler of our energy ambitions. This is a new inquiry, the aim of which is to scrutinise what electricity infrastructure will be needed to realise the ambitions that are set out in the Scottish Government's new draft energy strategy and just transition plan. The inquiry will be a short one that will lead to a report to the Scottish Government as it finalises its strategy.

Today, we will hold the first evidence sessions in the inquiry with two panels that comprise representatives of a wide range of interests in energy. I am pleased to welcome the first panel: Stuart Haszeldine is professor of carbon capture and storage at the University of Edinburgh; Clare Lavelle is director of energy and advisory leader north at Arup; Emily Rice is the Scotland policy analyst at Solar Energy UK; and Tom Quinn is head of analysis and insights at Offshore Renewable Energy Catapult. Thank you for accepting our invitations to be here today.

Before we move to questions, I remind members and people who are listening that, as a farmer and a landowner, I have electricity transmission lines across my farm in the form of 11kV lines, which are the small ones, and 33kV ring main lines, which are the bigger ones, and I am in negotiation for a 132kV power line to go through the farm. All those will generate some income at some stage for me.

I want there to be no doubt that I have some interests. I will make that declaration as and when it is appropriate to do so. I do not believe that that prevents me from doing my job as convener.

The first questions are from Liam Kerr.

09:45

Liam Kerr (North East Scotland) (Con): Good morning, panel. I will throw this question to Tom Quinn initially. It is about baseload and non-intermittent generation.

In Scotland, nuclear-generated energy is due to finish by 2030, I think. The draft energy strategy says that there will no new oil and gas exploration and production. Where do you think the non-intermittent generation will come from? I saw that, on 17 March, Torness was producing 42 per cent of the electricity produced in Scotland. When do you think that that replacement will happen?

Tom Quinn (Offshore Renewable Energy Catapult): Thanks for the invitation to the meeting.

There is a huge opportunity in Scotland for offshore wind primarily, although our focus is, obviously, on all offshore renewables—on tidal and wave energy, as well. However, our biggest focus is on offshore wind. Obviously, that comes with issues. There is a huge opportunity in building. If we are considering an electrified system and electrifying domestic heating and everything that goes along with that in Scotland, the time of year in which the most wind is produced is, in general, the winter. There is a big opportunity to heat homes through heat pumps through the winter. I hope that we will see a nice matching of demand and supply.

On the baseload, you have correctly highlighted that there is an issue with intermittency. Offshore Renewable Energy Catapult is pushing quite strongly on innovation and programmes to develop green hydrogen. We have been doing a lot of work on working out how that integrates with offshore wind and the wider energy system. The hope is that, if we are able to generate green hydrogen using Scottish and United Kingdom electricity and clean electricity from offshore wind and we are able to find ways of storing that, short-term and medium-term intermittency and long-term seasonal fluctuations in demand can be managed. We get periods of several days of low wind—we had those this winter. The idea is that we would be able to use green hydrogen to bridge that gap. Obviously, there is a big opportunity for UK jobs and the UK economy to benefit from developing that locally, as opposed to what happens in the current system, in which we import a lot of our gas.

Liam Kerr: I turn to Clare Lavelle. That answer was interesting, but it did not answer the question that I posed. When does green hydrogen, solar or any other renewable technology get to such a point that we can generate non-intermittent energy such that we have no further need for nuclear-generated energy or oil and gas-generated energy?

Clare Lavelle (Arup): It might be helpful to give some context and to split the forms of electricity supply and demand into intermittent, which our renewables are, baseload but inflexible, such as nuclear or biomass and carbon capture and storage, and flexible forms of renewables. From looking across the work of the electricity system operator and future energy scenarios, the Climate Change Committee has modelled lots of different scenarios and outcomes of different balances of all those sets of technologies. In the flexible bucket, we have a vast range of technologies that can offer the solution to matching intermittent renewables. Everything from storage batteries, pumped hydro, hydrogen power production and interconnection will, in a UK-wide system, be able to manage our supply and demand.

We need a very careful transition to ensure that, as generation comes offline and our energy demands shift to increase electrification, all the next set of technologies that will help us to manage that flexible system come online. Part of the work of the ESO is to do wider system planning and to really understand how that plays out in a Scottish context in the selection of technologies and solutions that we need to make the Scottish market work within the context of the wider UK market.

Liam Kerr: I have a final question for Emily Rice. Clare Lavelle rightly mentioned the Climate Change Committee. It has said, among many interesting things, that there will be more frequent and more intense weather events as we become more dependent on renewable energy generation. Do you think that, if we put so much development and time into renewable technologies such as solar and move away from things such as nuclear energy and North Sea oil and gas, we will be increasingly subject to the risks that the Climate Change Committee has warned us of and that our energy security will be threatened?

Emily Rice (Solar Energy UK): Thank you for the invitation to the meeting.

I do not think that renewables threaten our energy security at all. I think that climate change threatens our energy security far more than renewable energy does.

I think that “variable” is a better word than “intermittent” in relation to solar. Our technologies are variable. In Scotland, we are very lucky that, when it is not too windy, it tends to be sunny and, when it is not sunny, it tends to be windy. Therefore, we have natural resources that help to balance each other out. With other large-scale storage technologies that work very well with solar energy and wind energy, I do not think that moving to completely renewable generation will threaten our energy security at all.

Mark Ruskell (Mid Scotland and Fife) (Green): I want to pursue that point a little. Clare Lavelle talked about a bucket of flexible technologies that can be deployed—they are dispatchable technologies. Is there a route to market for each of those? You mentioned pumped storage, thermal generation, which could involve CCS, and battery technologies. Is there an effective route to market for all of those, or are some far from market rather than near market?

Clare Lavelle: There are emerging routes to market. For some of those, the market opportunity is near and established. For others, such as pumped hydro storage, there is an emerging route and engagement is going on with the UK Government to identify the full route to market, but there is not yet a fully established route.

With hydrogen, for example, the UK Government has started to develop hydrogen business models and has identified funding to support the first set of blue and green hydrogen projects coming to market. There is a route to market for the first tranches of development, but there is more work to be done to develop other aspects of the hydrogen economy. For example, things such as transportation and storage of hydrogen at a wider scale have not yet been developed. That is still in progress and there is consultation with the market. It is an emerging position, and we do not yet have the final solution.

Mark Ruskell: I will come to Stuart Haszeldine and then to the rest of the panel.

Professor Stuart Haszeldine (University of Edinburgh): I am usually more concerned with storage on the longer-duration timescale. We have talked quite well about storage for balancing electricity for minutes, hours or a couple of days, whereas I am much more interested in providing storage between summer and winter or storage for a week of low-wind weather. At the moment, we do that by just pumping harder on our methane gas supplies, so we do not really see the need for storage but, as we shift more to the mixed system in which there is no inherent baseload but we are always balancing the different types of energy supply, there will be a much increased role for storage.

That will probably be chemical energy at a very large scale. That chemical energy could be methane—many countries in Europe store methane—but we will probably be looking at hydrogen storage, as Clare Lavelle said. At the University of Edinburgh, we are doing a lot of work on hydrogen storage, which looks extremely feasible, both in sandstone rocks and in salt rocks. If we take a very parochial view, the problem for Scotland is that not much storage is available geologically in our part of the UK. Therefore, again, we will be driven to a UK solution, with UK-wide storage.

I want to highlight the quantity of storage required. SGN and DNV recently produced a report that suggests that, if we consider the whole energy system for heating and electricity—not just electricity—we will need to store something like 15 to 25 per cent of our annual energy. That is a huge amount, but it is similar to what countries such as Germany, France and the Netherlands store at the moment for gas supply. Work on that is in progress, but it will be needed much sooner than the progress suggests it will happen at the moment.

The committee could ponder whether we should be moving ahead much faster with hydrogen, because, whichever way you look at it, hydrogen will be part of the system, so it is a no-regrets option to invest in hydrogen now and within the next two years, rather than wait until 2030.

Mark Ruskell: We will come back to hydrogen in a bit more depth later. I will go to Emily Rice.

Emily Rice: Solar is quite a mature technology—I would not say that it is an emerging one. It is a technology that works uniquely well with storage, if we are still speaking about emerging markets.

As I said, solar is a mature technology and is incredibly versatile. It works in businesses and homes, and at utility scale. On the residential side, we are seeing interesting pilots and routes emerging to help reduce the cost of electrification of heat by using solar and storage to reduce demand peaks across Scotland, but also to help consumers who perhaps cannot immediately install a heat pump to soften the energy costs of electric storage heating and things like that.

We are also seeing innovation in agricultural photovoltaics, such as the use of solar panels to protect soft fruits such as raspberries on the east coast—solar can be installed above those. We hope that those kinds of solar continue to find routes to market, and that we see growth in utility-scale solar in Scotland.

Tom Quinn: I agree with Stuart Haszeldine that, for seasonal storage, hydrogen is probably the option. I would say that green hydrogen is not the magic bullet that will solve all our problems—it is almost the last thing that you do. When you generate a megawatt hour of electricity from a wind turbine, you want to use that as effectively as possible, and the most effective way is to put it into a heat pump and use it for whatever power demand there is. It is only once you get beyond that point and have no effective use for it and it would be curtailed that you start looking at generating hydrogen or coming up with alternative uses.

This is getting slightly into the market side, but there is not necessarily an incentive for wind power developers to start developing electrolysers. At the moment, under their contract for difference, they are paid a set amount for every megawatt hour that they generate. However, when we look at a broader market, that is when we will start seeing shifts in the wholesale price and opportunities for businesses to start developing green hydrogen production facilities, when prices are low.

The Convener: Before we leave that, if we went more to a hydrogen system—I know that members will ask about that later—would that get rid of the need for constraint payments, which are quite big?

Tom Quinn: Yes, although it depends on where the electrolysers are sited. You could have a

system where they are centralised and excess power from all over the country goes to them. The other alternative is that you generate hydrogen at the wind farm sites and then, as Clare Lavelle said, find ways of transporting that hydrogen to market.

The Convener: Clare, you can come back in briefly, if you want—if you are going to give me the good news that constraint payments will no longer be paid.

10:00

Clare Lavelle: With all these technologies, there is a market solution and a technical solution. The range of technologies can help with the technical solution, which can be just investment in more infrastructure, but it can be use of the various technologies to remove the constraint. The constraint payments are part of the market design, so you also need to assess the impact on the market design to be able to remove the use of constraint payments. Therefore, both have to be considered in parallel.

The Convener: I always think that it is difficult to justify payments for doing nothing, and I think that the public find that difficult, too.

The next questions are from the deputy convener, Fiona Hyslop.

Fiona Hyslop (Linlithgow) (SNP): Good morning, and thank you for joining us. I would like to discuss wind power and the readiness of the electricity network. What are the key barriers to achieving the ambition for offshore wind contained in the Scottish Government's draft energy strategy? Could the readiness of the electricity network to accommodate new projects affect the business case for the proposals? What needs to be done to our electricity network in the short, medium and long terms? I will come to Tom Quinn first and then to Stuart Haszeldine.

Tom Quinn: There are a number of barriers to achieving the targets that have been set out in the draft strategy. At the Offshore Renewable Energy Catapult, we are less focused on the transmission side but, obviously, we see that there are constraints. We are investigating various solutions, such as high-voltage direct current cabling and potential east coast connectors between Scotland and demand centres in the south of England.

However, there are other barriers that we need to address. One is the readiness of other infrastructure in Scotland, such as ports and manufacturing capability. We need quite high levels of investment to create the opportunity. There are two ways of viewing the issue. The first is that, if we do not invest in certain areas of infrastructure such as ports, the projects cannot go ahead, because we have to have the ports to assemble wind turbines and get them to sites. The other risk is that, if we do not invest in things such as manufacturing, we will lose out on jobs, supply chain growth and the benefits around that. There are risks on that side.

The other challenge is around skills. Obviously, in the north of Scotland, we have lots of oil and gas workers at the moment. With some of those roles, there is a natural transition into offshore wind, but it is not always like for like, because the roles are slightly different. With industry, we are investigating the different pathways and the skills that will be required.

On infrastructure, we need some fairly significant upgrades in the grid, but there are other options here for power to X. Hydrogen is one example of that, but there are other solutions.

Fiona Hyslop: We have a particular interest in the electricity network. Stuart Haszeldine, your overview on that would be helpful.

Professor Haszeldine: I am not the world expert on the electricity network in Scotland but, from talking to colleagues and from several years of observation, I think that the connectivity through the landmass of Scotland will be a big blockage in connecting a lot more of the offshore wind into our grid network. We are looking at developing the ScotWind suite of projects around the north coast, where there is huge offshore potential, but getting that electricity to the market is very difficult, because it needs to come through the landmass of Scotland, and the established network is nowhere near up to that. The main constraint there is not the engineering, I guess, but the planning permission rate—think about the history of the Beauly to Denny power line. If we want another four or five of those, that will slow the connectivity of offshore wind to some time in the 2030s or later.

That raises the question about power to hydrogen. One way of getting access to that offshore wind energy is not to transport the electricity, but to take the electricity to shore or to use it offshore to generate hydrogen and then to transport the hydrogen. That is an option. I have not examined that in huge detail, but it is an option.

Another obstacle is locational pricing in the UK system. Electricity generation further and further away from the centres of demand—the population centres—is more and more difficult to develop commercially, because a price penalty is placed on that.

Those are interlocking and complicated problems, and it is not clear to me how to break through that to give investors the confidence that they will be repaid in an adequate timescale if they try connecting any of these larger offshore assets.

Fiona Hyslop: Thank you for that overview.

Arup's submission states:

"We would support SSEN's position that Ofgem would benefit from having a more central and explicit statutory obligation to enable net zero."

In terms of the electricity network being anticipatory of demand as opposed to responsive to it, I ask Clare Lavelle to give her insight as to what is needed for the network in the short, medium and long term.

Clare Lavelle: There have been really positive changes through regulatory reform in the network space in the past couple of years, in response to the growth in ambition for offshore wind and to deliver the work that the Office of Gas and Electricity Markets has been doing on holistic network design. That looks at much more integrated and efficient networks, and at longer-term solutions that give confidence to invest in the infrastructure that we need. It involves considering the long-term solution, rather than what is cheapest in the short term but is not necessarily the most economical solution.

A lot of the work that has been happening with Ofgem through the accelerated strategic transmission investment—ASTI—programme has given confidence to our transmission operators to be able to progress and bring forward infrastructure that will be needed to deliver net zero. That is a really positive step forward.

The work that was done for those ASTI projects—the accelerated projects—was done in the context of what was understood to be leased through the ScotWind programme, so about 11GW was assumed at that point. We now have about 27GW of new leased projects, and we have further leasing that is coming through the innovation and targeted oil and gas—INTOG—leasing round, so what was in the regulatory settlement period does not represent the full set of projects that are being leased and progressed at the moment. Further work needs to be done to understand the infrastructure needs for those projects.

There are some big challenges. Despite the commitment to deliver that infrastructure, there are still barriers ahead. It represents a vast growth in the amount of major infrastructure that we will be bringing through the system compared to the situation historically. There are, therefore, real constraints in the supply chain, which are about the technical capability to design and deliver, as well as simply the supply of equipment and plant to the projects. That needs to be addressed.

The planning process has represented a significant blocker to bringing projects and expediting them through the system. We need to be much slicker in how we design and progress those projects.

I could talk about hydrogen in response to Stuart Haszeldine, but I could leave that.

Fiona Hyslop: I will come on to that in a second.

Emily, what is needed for solar from the electricity network?

Emily Rice: First and foremost, for solar, it would be hugely helpful to have a level of national ambition by setting a deployment ambition by 2030. That is because, at the moment, solar tends to be a bit of a footnote in distribution network operator strategies. DNOs are required to justify all the investment that they make in their network. At the moment, because there is no signal from the Government that it wants a certain amount of solar to be included in the energy mix, DNOs do not account for solar when they are justifying their investment to the regulator, Ofgem. Without that ambition, solar simply is not included in DNO strategies and it is harder for solar to get grid space.

On the regulatory regime, I completely agree with Clare Lavelle that there has been a lot of progress in the past couple of years but, as it stands, the grid is not designed for the system that we are moving to. Over the past 20 years, the price of renewable electricity has dropped dramatically. When the grid was designed and regulations were set up, the regulators simply did not expect a lot of small-scale renewable generation connecting to the grid.

Therefore, the system is just not set up to expedite that process. It is not set up to invest ahead of need, which is what solar needs. Like every other technology, we need more investment in the grid and more capacity. It is not a question of, "If you build it, they will come." We are already here, and we are asking very much for grid space. We need to give the networks the freedom to invest ahead of need and to build out further. We need to design a grid for net zero and not try to adapt what we have for the new technologies that we did not expect 30 years ago.

Fiona Hyslop: I saw some nods from the panel there.

I will move on to the potential for generation and market ambition, particularly in relation to hydrogen. I was at Grangemouth Ineos yesterday, hearing about the plans for the Acorn project, which was very interesting indeed. Professor Haszeldine, could you give us a point-in-time view of where you think hydrogen could be? I am interested in the movement to green hydrogen and, in relation to offshore generation, the balance between electricity going into the grid and the

potential for it to be used for hydrogen. Are we in a different place now than we were two years ago or perhaps even 12 months ago? How optimistic are you that we can shift the dial on the hydrogen side of things?

Professor Haszeldine: Plenty of studies are happening and there are plenty of opportunities and lots of enthusiasm for hydrogen, but we still need to be cautious or realistic about the availability of green hydrogen in the immediate term, because that depends on availability of lots of electrolysers, which is the equipment that can pass current through water to make hydrogen and oxygen. Those electrolysers are not yet fully commercially available at the scale and the numbers that we need. We then need a lot of electricity to supply those electrolysers. Although we are progressing very well on producing lots of low-carbon electricity, as we discussed earlier, we will need even more if we are trying to use green hydrogen to replace methane gas. I see that as a slow and continuous progress, which will possibly take 10 or 15 years to get us to anywhere that we want to be.

We also still need to look at blue hydrogen, which is the hydrogen by splitting methane molecules into CO_2 and hydrogen. It is therefore no surprise that there is a big push from oil companies to sell us lots of methane. We have to be a bit careful that we do not get locked into a cul-de-sac by investing for 30 years or 40 years of blue hydrogen and squeezing out the market for green. There is a balancing act to be achieved there and, of course—we may come to it later—at the moment, in the Scottish part of the UK, we have no ability to store the CO_2 from blue hydrogen. The Acorn project and the associated Scottish cluster of CCS has to be adapted to enable blue hydrogen, otherwise we will be a nation that is exporting all our CO_2 by shipping or by pipe down to storage sites further south in England and the North Sea and losing a lot of value.

I see green hydrogen progressing, but not very quickly immediately. The price of green hydrogen in Scotland can fall and it is projected to fall as the equipment becomes more and more standard. The price of green hydrogen is projected to fall by about half by the late 2030s, but how fast we get there is not known to me at the moment. Of course, there is no pipeline system yet. There is a clear and present need for that, and it needs to be sorted out.

Fiona Hyslop: Tom Quinn, do you want to comment?

10:15

Tom Quinn: There are a few areas to mention. A big focus for us is innovation. At the moment the innovation and funding background is a bit scattered, with lots of different sources. It is not enough to enable us to move from where we are now, doing feasibility studies, through to executing strategies. There is a requirement for greater funding in the green hydrogen space.

I agree with Stuart Haszeldine that we need to build this out. We cannot do it at the risk of sending electricity to electrolysers and then having to backfill with more natural gas for power. That does not make a lot of sense.

There is some demand for hydrogen. It will be a little bit difficult to balance the demand and supply sides. We would expect that, once we start to grow a supply, a market to use the green hydrogen would be created, but the main focus for us at the moment is on the innovation and research and development space. It is definitely possible to reach the targets that have been set: 5GW by 2030 and then 25GW by 2045. It is definitely possible to reach those, but the short-term goals of matching the supply and demand will be challenging.

Fiona Hyslop: Finally, Clare Lavelle, do you have any comments on that? The issue is about the balance between offshore generation and transmission and the potential for green hydrogen. At what point does that reach an equilibrium? Is that one of the market challenges?

Clare Lavelle: It is a challenging target: 5GW by 2030—it is 10GW in the UK. It took 20 years for the UK offshore wind industry to reach 10GW-worth of installed capacity from a standing start. That does not necessarily represent the technology's ability to deliver, but it gives you an idea of the sustained support that you need to be able to grow and accelerate an industry.

There are some very mature technologies in blue and green hydrogen. Electrolyser technology has existed for 100-plus years, but what we do not have is deployment at scale. Particularly for green hydrogen, we do not have the pipeline yet that we need, although we think that it is likely to be emerging with the business model funding.

One of the big interdependencies in the network is around the establishment of the future system operator. Currently, we plan our electricity network largely independently of our gas network, and the purpose of the establishment of the FSO is to make sure that we do better system-wide planning so that we understand how those systems interact and how we can deliver much more efficient systems that deliver better outcomes for consumers. The FSO is due to be established in 2024, I understand, so we are a little way away

from the point where we are doing properly efficient system planning and understanding what we need in gas hydrogen networks that complement our electricity networks. That desperately needs to be accelerated; it is not moving at the pace that we need.

The Convener: Stuart Haszeldine, you made a comment that I could let slip by about the Beauly to Denny power line and the time that it took. Could it have been speeded up if we had thought about undergrounding it? I will declare that I was involved in it from an environmental point of view.

Professor Haszeldine: I am trying to remember back. A large number of the objections were certainly concerned with the scenic aspects, let us call it, or the landscape impact. In principle, I guess that you could underground power line, but I remember that electricity companies provided us with lots of evidence that undergrounding would bankrupt them somehow.

Those are planning choices that we have to make, and that is part of what can be helped by the political landscape in Scotland. There is no doubt that in any of these things, planning is a huge drag on progress and, of course, you have to balance democracy and the interests of local citizens with what is engineering or technologically feasible.

The Convener: Most of the upgraded power lines will follow the best route, which is where the 132kVs are. Those will not be dismantled until the next ones are put up, but the companies will want to keep the old ones up as well. A solution is to underground them. That is just an observation.

Professor Haszeldine: I did not say that. You said that for me, just to be clear.

The Convener: I would love you to say it as well.

Professor Haszeldine: That could be an engineering solution, but I am absolutely not qualified to say whether that is a sensible thing to do.

The Convener: I just made that comment.

The next questions are from Monica Lennon.

Monica Lennon (Central Scotland) (Lab): I want to return to the draft energy strategy, which I note does not have specific ambitions for marine or solar deployment, although it does recognise the potential role for hydro at small scale, involving local communities, and at a larger scale. Can the panel explain whether it is important to have specific targets? If it is, what should they be? I will start with Emily Rice, because I think that you said that solar is a bit of a footnote in the strategy. I am keen for you to elaborate on that and on the question about targets and how important they are.

Emily Rice: When I said that they tend to be a footnote in DNO strategies, that was essentially because we do not have a national ambition, although we have a strong rooftop market in Scotland. When DNOs look at designing their investments and their grids, they are aware that solar is different from wind and other technologies, because most of the time it connects at the distribution level instead of the transmission level.

Essentially, DNOs have to go to Ofgem with spending plans and say, “This is how we will invest our money and this is why.” If there is no national ambition for solar, there is no evidence for them to say, “The industry is telling us that it will put in 4GW of solar by 2030.” There is not really a strong enough reason for Ofgem to say, “Yes, then you should invest to plan for that.” However, if the Scottish Government says that it would like to have 4GW of solar by 2030, Ofgem will say, “Right, you are preparing your network for that, because the Government has signalled that it wants that to be part of the energy mix.”

That is incredibly important for not only the confidence of DNOs, but the supply chain. If we are talking about investing now in things such as building up skills and making sure that we have a good supply chain of the materials that we need to buoy up that amount of solar, it increases investor confidence to know that there is, in fact, a supported market in Scotland that people can invest in. I have had many solar developers say, “There is a lot of land in Scotland, but I am just not sure about the planning system there,” but utility-scale solar is definitely starting to turn towards Scotland as an option.

There are a lot of reasons why we think a national ambition is important. The grid is certainly an important part of that, but so are skills and investing in the sector ahead of 2030.

Monica Lennon: Before I move on to the rest of the panel, what would a realistic ambition or set of targets for solar in the strategy look like? What would satisfy you?

Emily Rice: We believe that 4 to 5GW could be deployed by 2030. That is a reaching ambition, certainly, but it is a realistic one. We have seen record deployment in Scotland over recent years, and the industry continues to take off. With the national planning framework supporting more development of utility-scale solar, we believe that there is absolutely no reason to think that we would not be able to reach that target by 2030.

Monica Lennon: I will come to Tom Quinn next and ask again about specific targets for marine, solar and hydro. I do not know whether you want

to answer across the board or just pick out one of those.

Tom Quinn: I will focus on marine energy—wave and tidal. Targets have been very useful for offshore wind, and we are fully behind that ambition and think that it is a good thing. Wave and tidal are still at a fairly early stage. We have seen only some smaller-scale and pre-commercial projects, so setting targets for wave and tidal will be more challenging, but the ambition is good.

What we then need to do is get from setting the targets to creating all the enabling actions to deliver on those targets. We are supporting Government and industry on identifying what the barriers are, trying to quantify them and working out ways to remove them.

For certain offshore renewables, it is almost more important to have an annual target for what you want to be doing in every year rather than having a big target for 2030. Having the latter means that we have to build a lot in a short period of time without having that longer-term view of what happens after that, which can mean that we overbuild everything and then not build more further into the future. We need a steady, clear pipeline of projects that will encourage investors and the supply chain and give visibility to the grid and everything else that goes along with it.

Clare Lavelle: I agree that targets help and signal an intent. The only thing that I would add is that we also need better system planning. Understanding what will be delivered and where, in terms of transformation of demand for low-carbon solutions and the supply of electricity—or otherwise—to those systems, helps us to plan our networks better. They are very long-lead infrastructure items, so the sooner we can plan for that, the better.

Monica Lennon: Stuart Haszeldine, do you have anything to add?

Professor Haszeldine: I have nothing major to add. I believe that targets are useful to signal intent, particularly when you are putting in large capacity for the future, whether that is a pipeline or an electricity wire. I would also say that not everything needs a development target, because some of these technologies are still in the pilot and demonstration phase. Some technologies are not ready to build yet.

Monica Lennon: The technologies that we have just discussed receive less attention in the draft energy strategy. Can any or all of them play a significant role in the Scottish electricity system? Today we have heard a little bit about the important role that the planning system can play and local government more widely. Our committee just had a big inquiry into the role of local government in net zero and we had a committee debate in the chamber last week—I am sure that you were all listening to that. Do you have a view on how best local authorities can support our ambitions? Skills and planning have been mentioned. Do you want to add anything else to that? I will put that to Stuart Haszeldine first.

Professor Haszeldine: I will answer in a general way, rather than with regard to a specific technology. Local authorities can easily be overwhelmed by the detailed technical asks, which they have been totally unskilled for and totally unaccustomed to. I have often thought it might be useful to have a more central facility in Scotland to dispense and disperse information. The Convention of Scottish Local Authorities, for example, could draw upon that central expertise to help when it is faced with a sudden application for the world's best tidal development and it knows nothing about tidal. How will it decide? Local authorities need skills and help.

Clare Lavelle: Planning plays a large part of it. I would defer to Scottish Renewables—you are hearing from someone from Scottish Renewables in your next session. They will be able to speak more credibly than I can about the application of the planning system.

The other thing to be aware of is the role of local authorities in the development of local heat and energy efficiency strategies, which play a critical role in planning for decarbonisation of demand and supply within local authority areas. There needs to be appropriate resource in that area to support local authorities to be able to implement those plans.

In particular, there are areas where, within their own assets and estates, local authorities have opportunities to catalyse activity and investment. If you look at hydrogen, you can see that creating a transport demand for a public sector fleet, for example, can really help to kick-start some of these new industries.

Monica Lennon: We have seen examples of that on some of our visits to Aberdeen, where we saw hydrogen bin lorries.

Tom Quinn: We work with local authorities already through clusters around the UK that are centred around offshore wind development. I will use this opportunity to offer an invitation to any local authorities that are looking at marine energy and offshore wind. We are independent experts on those things, so we always welcome to support them on that front.

Emily Rice: We definitely welcomed some of the changes in the national planning framework 4. Some of them encourage local authorities to approve projects that help reach Government ambitions. To go back to why ambitions are important, they send a clear signal to local

authorities as well. I definitely agree with Clare Lavelle's point about resourcing local heat and energy efficiency strategies and also just making sure that local authorities are able to resource and invest in the skills and the people that they need to approve and resource projects. We need to support local authorities to invest in skills so that the benefits of the renewable transition, in terms of jobs and infrastructure, stay in those communities.

10:30

Jackie Dunbar (Aberdeen Donside) (SNP): Good morning, and thank you for coming along. I will return to the issue of hydrogen. The draft energy strategy says that Scotland has a strong ambition for a hydrogen economy. With that in mind, are the potential uses or the markets that we have for hydrogen adequately understood? What needs to be done to allow businesses to invest with confidence? I will go to Clare Lavelle first.

Clare Lavelle: There is a vast range of solutions in which hydrogen can play a role. There is a hierarchy of interests. In particular, there are applications where electrification as a decarbonisation solution just does not work or it is very challenging. We have a lot of industrial processes that need very high heat, which is difficult to achieve with electrification. There are also a lot of transport solutions in which electrification does not work—I am thinking of, for example, shipping and heavy goods vehicles. That creates significant demand. We should really accelerate and focus on the use in those applications in which we know that hydrogen is the solution.

There is some wider debate on the wider range of roles that hydrogen can play in other applications. In particular, with something like heat, there are diverse opinions about where hydrogen is the best solution. However, that could have a huge impact in terms of the range of hydrogen that we need to produce and where we need to deploy it.

It is critical that we make some short-term decisions on what the no regrets, easy-win solutions are and really accelerate and progress those, but we need to work hard on building the evidence base and deciding on the wider set of applications in which we will use hydrogen.

Tom Quinn: On the market side, something that has supported renewable development and deployment over the past 20 years has been the ability to have an offtaker of last resort, to make sure that whatever you generate can be sold and that you can get some revenue from that. That is critical for green hydrogen production. A potential option for that is the gas grid. My understanding is that—this is not very technical—some hydrogen can be absorbed into the grid without it having to be adapted.

In terms of the innovation challenges that we are facing, we are working with other catapults in a hydrogen innovation initiative to help co-ordinate and address some of the challenges around all aspects of the hydrogen market and the design of that.

Finally, we are seeing a lot of activity in the European Union and a lot of funding going towards green hydrogen. It is quite important that we do not lose our competitive advantage on this front.

Jackie Dunbar: Stuart Haszeldine, do you have anything that you would like to add?

Professor Haszeldine: I go back to what we touched on briefly before. If we look at the whole system of energy, one of the main storage opportunities for energy between seasons is chemical energy—hydrogen. As well as examining individual examples on a local scale and on an immediate scale—like those that Clare Lavelle has just mentioned—we also need to bear in mind the larger grid operation scale, where hydrogen might be preferred for the security that it gives in storage, even though in a particular application electricity sometimes might be better. In many places, electricity is better. That is one thing to consider: do not lose sight of the large scale.

I totally agree that on vehicles or transport, whether it is HGVs, buses, shipping or trains, hydrogen seems to have strong advantages. I will mention one the hidden costs that we have looked at briefly. If you install batteries in a lot of the big vehicles, the axle weight increases, so there is huge potential for more road damage, which would end up as an unforeseen problem for local authorities.

Again, we need to be wide ranging in our review, but building centres and fleets is a way of disseminating hydrogen at low risk into the big vehicle fleet.

Jackie Dunbar: You said earlier that one of the key barriers is that no pipeline system is in place for hydrogen at this time. Is there anything else that needs to be addressed with regards to infrastructure? How can we address those issues?

Professor Haszeldine: Tom Quinn was quite right: you can in principle feed hydrogen into the existing gas grid. However, we need to be generating that hydrogen somewhere. The logical place to do that in Scotland would be at St Fergus, where the methane comes onshore, as you are probably aware. At the moment, we are stuck on that one.

There is also still quite a huge design problem if we were to use hydrogen for heat pervasively

through domestic housing. There is the switchover problem about how you would scale up that percentage of hydrogen into the grid and how you would convert houses.

In some cases, if you are supplying an electrolyser through the gas grid, that electrolyser needs really pure hydrogen—it needs to be 99.9 per cent pure—so there is also a need for purification or polishing of hydrogen before the final use.

All those issues are being investigated, but it is not clear who will move first, when and how.

Jackie Dunbar: Clare Lavelle, you are looking at me. Do you have anything to add?

Clare Lavelle: It might be useful to split the two different types of gas networks. We have a gas distribution network that supplies directly to people's homes for use in heating and cooking, and we have a gas transmission network that is about bulk transmission of gas throughout the country.

There is discussion and debate on the role of hydrogen in the gas distribution network, but a decision on that is not due until 2026. However, there absolutely is a need to have a gas transmission network to which we connect all our hydrogen production hubs, so that we can distribute hydrogen not only around the UK but to Europe, to ensure sure that we have an integrated transmission system.

We should be making that decision sooner rather than later. One of the Climate Change Committee's recommendations is that, due to the long lead time of that infrastructure, we need to start to progress the plans. There are plans for a European hydrogen backbone and there are plans for project union at the UK level. There is more work that we could do to identify the production opportunity of hydrogen in Scotland and how that feeds into those wider plans, to make sure that that is fully integrated into whatever decisions we make on our gas transmission network.

Jackie Dunbar: The Scottish Government's ambitions for—

The Convener: I am sorry to come in just as you are moving on to your next question—I do not like to stop you mid-flow—but Collette Stevenson is quite keen to come in on one of the points that has been raised. I am happy to bring her in and then I will come straight back to you.

Collette Stevenson (East Kilbride) (SNP): Thanks very much, convener. Good morning. Given what you were talking about, I want to touch on district heating systems. I also sit on the Criminal Justice Committee and one of the issues that has come up in the past is the use of district heating systems in our prison estate to deliver energy and to create revenue. Stuart Haszeldine, do you want to comment quickly on that? I do not want to steal Jackie Dunbar's thunder.

Professor Haszeldine: I observe that we have district heating in the University of Edinburgh, which has four or five district heating systems in and around the town. The value in that is the efficiency of the centralised heat through methane gas. At the moment, the university is a bit stuck in its decarbonisation, and it is wondering whether to carry on burning gas, to switch to hydrogen or to totally electrify. That is not an answer, but it is an example of the difficulty in making a decision in relation to what the future will be.

Clare Lavelle: There are solutions in heat decarbonisation through electrification. Heat pumps are an absolute must and we should accelerate their use. In heat networks, there are areas where that makes a lot of economic sense, when you can find low-carbon sources of heat alongside demand, and we should accelerate those.

The wider question is: what is the role of hydrogen within heating? Are there areas that are difficult to decarbonise using the other solutions but where hydrogen can play a key role? Where should we accelerate its use? It is really about understanding the best solution for the best application, of which heat networks are absolutely one.

The Convener: I think that we have pushed that as far as I can allow it to go, just because of the shortness of time. Back to you, Jackie.

Jackie Dunbar: I was going to ask Clare Lavelle a question about the Scottish Government's ambitions for 5GW of hydrogen production by 2030 and 25GW by 2045. How much of that should come from green hydrogen? What will the reality be in trying to get to that target mean?

Clare Lavelle: In the short term, blue hydrogen is considered to be lower cost. We have projects within Acorn that are very well developed that could provide hydrogen at scale in the context of the 2030 targets. They have not currently been selected for funding under the Department for Business, Energy and Industrial Strategy cluster-sequencing process. They were put as a reserve project on the track 1 cluster, so there is some uncertainty about the route to funding those clusters. Without that funding, that project will not be realised.

In the longer term, green hydrogen is likely to be lower cost. Scotland has an excess of renewable sources. We have a huge capacity just in the ScotWind leased sites alone. Green hydrogen is zero carbon rather than low carbon, so it does not create the challenges that you have with blue

hydrogen, where you have to do some offsetting by other means. Green hydrogen certainly has to play a major role in reaching the 2030 targets and it should absolutely be the dominant solution by the time that we get to the 2045 targets.

Tom Quinn: I want to highlight that a risk around blue hydrogen is that it creates an import dependency. If you invest public funds into a hydrogen project, it should be green hydrogen because we will not want to be reliant on volatile markets. Over this winter, you will have seen the risk of relying on international gas markets.

I highlight that as a risk of investing in a big way into blue hydrogen. We should invest in the early-stage green hydrogen and create the expertise that we can export to international markets.

Jackie Dunbar: My final question is for Stuart Haszeldine. How critical is it to Scottish electricity decarbonisation for there to be a Scottish CCS cluster?

Professor Haszeldine: We still have the dilemma about whether to have a CCS cluster, and it is up to the UK Government process to decide whether it awards funds. If we have a CCS cluster, we can develop blue hydrogen rapidly, we can develop negative carbon emissions by direct air recapture and we can develop negative emissions by using some biomass to generate hydrogen or biomass to generate heat. All those options become available.

If we do not have a CCS CO_2 storage pipeline, we would lose the ability to transfer offshore skills into that, and we would be dependent on shipping to export any of our CO_2 to another part of Europe, whether that is Norway or England.

I still see the CCS part in terms of net zero as essential. Let us remember that net zero still permits some emissions from agriculture, forestry, transport or anything else, but those will be balanced arithmetically by recapturing carbon dioxide. If we cannot send our carbon dioxide away for storage, it becomes a more expensive and difficult option to get to net zero. Does that answer your question properly?

10:45

Jackie Dunbar: I think that you are saying that you believe that to be critical, but I do not want to put words in your mouth.

Professor Haszeldine: Yes. It would be very strange to have a whole region of the UK deprived of that low-carbon facility.

Jackie Dunbar: If the rest of the witnesses do not have a different view, I will hand back to you, convener.

The Convener: You have just told them they do not have a different view so—

Jackie Dunbar: I meant that, if they do not have anything else to add, I would hand back to you, convener. Sorry, I do not like putting words into people's mouths.

The Convener: No one is jumping up and down. Thank you for handing back because we are short of time. I would like to go to Liam Kerr and then come to Collette Stevenson.

Liam Kerr: Picking up on the last point that Stuart Haszeldine made, I note that the draft energy strategy has a presumption against new oil and gas exploration while, at the same time, committing to developing a Scottish carbon capture use and storage cluster. Given the key role that the North Sea fossil fuel companies will play in developing skills and funding CCUS and other renewables, is there, in your view, a risk that the draft strategy's positioning might hinder development of a Scottish cluster, to say nothing of other renewables such as hydrogen?

Professor Haszeldine: In simple language, are you asking whether we should continue developing oil and gas or are you asking something different?

Liam Kerr: I am asking whether, in its presumption against new oil and gas exploration, the draft energy strategy might inadvertently hinder the development of the technologies that we have heard so much about.

Professor Haszeldine: I am not in the boardrooms of major transnational oil companies, but I do not see why what you have referred to would hinder separate developments. Similar skills and technologies might be used, but they are entirely separate projects.

My personal view is that, if the UK is heading towards trying to become a net zero economy, I have to wonder when we will cross this bridge to actually stop oil and gas production and switch, with a full heart and mind, to decarbonisation and building that sort of network. The companies that are actively involved in that at the moment are the big transnational oil companies that clearly have plenty of cash in the bank. The issue is the choices that they make rather than the skills portfolio; they are the ones who choose where to invest their money.

Liam Kerr: For my next question, I go back to what Clare Lavelle and Tom Quinn said about the import risks of blue hydrogen. Clare, your submission talks authoritatively about blue hydrogen and CCUS, highlighting their role in the transition for the oil and gas industry, but you also note that imports of gas

"will increase ... if reliance on gas does not reduce",

and then you refer to

"significant risks to security of supply in an increasingly volatile geopolitical environment."

If we accept that demand for power in the United Kingdom is likely to remain high for some time, and might even increase, given certain choices that we make, should this aspect of the energy strategy—the presumption against exploration—be reviewed, not only for the sake of energy security but to ensure the development of, say, hydrogen?

Clare Lavelle: There is no simple answer to that question. The Climate Change Committee has a position on this, which I will try to replicate as accurately as I can.

It is worth noting that we import significant proportions of our gas supply from outwith the UK basins and the carbon impact of doing that is significant. One major issue with gas production is fugitive emissions of methane, which is a pernicious global greenhouse gas and, in the short term, has a significant impact compared with carbon. With regard to the global gas market, we need to be concerned about where outwith the UK we source our gas from, as other nations might have high fugitive emissions that are at levels above UK levels. If we are going to use gas within the system, it is important that we are aware of where we source that gas from and the wider carbon impacts, and we must also make sure that we abate it and capture carbon at the point of use.

Equally, there is a general need for us to accelerate as quickly as we can our use of hydrocarbons. We have to use less oil and gas within our system if we are to meet our net zero targets, and we must consider with caution any existing exploration activity in the UK when we do not know whether it will be compatible with those targets. Although we absolutely need to consider security of supply, we should also recognise that accelerating the reduction of use will be much more critical, given that any additional exploration activity that we do in the UK is unlikely to make us gas independent, simply because of the balance of our gas supply.

Liam Kerr: I am grateful for that response.

The Convener: We come to Collette Stevenson for the next lot of questions. [*Interruption*.] Tom Quinn, I would love to let you in, but my problem is that I am short of time. I would certainly appreciate your input but I cannot stop a committee member getting in, because I will have to live with them in future sessions.

I call Collette Stevenson.

Collette Stevenson: I want to focus on Ofgem and the energy markets. On the back of the recent review of electricity market arrangements, it has been proposed that gas prices be decoupled from electricity that is produced by renewables. Are you aware of any operational changes that Ofgem has recently made to support the delivery of a decarbonised electricity system? Could more be done to support a more regulated regime that delivers a more decarbonised energy supply? I believe that the issue was touched on earlier in response to Liam Kerr's question about gas imports into the UK and contractual elements with regard to the price of importing gas. I will go to Clare Lavelle first.

Clare Lavelle: I will not talk about the network reform that is associated with network investment, as I have already touched on that. In any case, you will be hearing later from the network operators, who will talk about that issue.

I would say, though, that the other thing to be aware of is the recognition in the review of electricity market arrangements—or REMA—of the significant challenges in our current market system. It is clearly not delivering for generators in terms of their being able to access the market, and neither is it delivering for consumers. After all, we have some of the most expensive electricity in Europe.

Market reform is still at the early consultation stage, with options on the table that range from evolution of what we have at the moment to some big transformation as a result of looking at the different market models. That review will be incredibly critical to the Scottish market.

Tom Quinn: We are not particularly close to the regulatory side and to Ofgem, but echoing what Clare Lavelle has just said about REMA, I would just say that there is a spectrum of options. At the moment, the consultation responses seem to be saying that, in effect, everything is still on the table. That just highlights what a complex topic this is—there is no simple solution to it.

On the offshore wind side of things, the issue of decoupling has been mentioned. The fact that we generate a lot of renewable energy in Scotland is important, and it would be great if all our consumers had access to cheap and affordable power. We need to make sure that we are still incentivising investment in future projects, too.

Emily Rice: Like Tom Quinn, we are not superclose to the regulatory regime. We certainly welcome some of the recent changes that Ofgem has made. Overall, regulatory frameworks need to be much more agile than they are currently to allow investment ahead of need and innovation ahead of net zero.

There are some options that solar energy, in particular, could benefit from. I will not comment on whether these options are the correct ones, but you could decentralise energy networks and use

network charging to reward consumers who consume local supply. In other words, if you have solar arrays and so on and the energy that is produced is completely consumed by the community, you will not have to pay charges for transmission that you do not need in order to carry the power elsewhere. That sort of thing already happens in Portugal and France, and it is an option, but it would require a different regulatory regime.

As Tom Quinn and Clare Lavelle have said, there is a vast spectrum of options. Everything is on the table right now and things are changing, but it will be important to have a more agile regulatory framework and thinking around some of the more out-of-the-box solutions.

Professor Haszeldine: Again, I am not, as the phrase goes, superclose to all this, but consumers seem to be getting a progressively worse deal as we shift from 100 per cent fossil fuel to 100 per cent everything else. Anything that gets us further in the direction of what is, in effect, a pick-and-mix menu of cheaper electricity and cheaper power seems pretty sensible. We are only part way through the transition, and we will have to deal with different sorts of renewables and methane and gas mixes, so flexibility and adaptability will be important.

It is also important that we do not go for totally locational pricing, because we will end up with expensive electricity in the outlying parts of the UK. A big plus for me would be having some sort of postage stamp operation in which everybody in the UK pays a similar price.

The Convener: Collette, I am sorry, but I can let you ask only one more question and only to one person, so you must choose your question and your answerer carefully. I was going to say "victim", but that would not be right.

Collette Stevenson: The Climate Change Committee has recommended the establishment of a Great Britain-wide electricity infrastructure delivery group to ensure effective co-ordination between all the UK Administrations. Would you support that and, if so, what should its priorities be? I will bring in Clare Lavelle, first of all.

Clare Lavelle: You are probably referring to the establishment of the future system operator, which is the evolution of the electricity system operator both to bring in gas and electricity planning and to have more centralised strategic system plans. I welcome the move, because it is what the industry needs if it is to understand the infrastructure that is required for efficient delivery, to accelerate net zero and to deliver efficiently for consumers. It is well supported by industry.

Collette Stevenson: I will get into trouble for this from the convener, does anyone else want to come in and comment quickly? If not—

The Convener: Absolutely not. I will allow one more person to respond.

Professor Haszeldine: We will hand the time back to Collette.

The Convener: I think that we have probably got what we need. It was a nice try, Collette—I am sorry that I could not let you do it.

It has been an interesting session, and I thank the witnesses for their evidence this morning. The fact that we started late and have still run on past the time that we were originally going to have proves how much your evidence is valued. Thank you very much.

I suspend the meeting until 11.05 am to allow for a changeover of witnesses.

10:59

Meeting suspended.

11:05

On resuming—

The Convener: We move to evidence from the second panel that joins us today as part of our inquiry into Scotland's electricity infrastructure and whether it is an inhibitor or enabler of our energy ambitions. On behalf of the committee, I am pleased to welcome Scott Mathieson, who is the network planning and regulation director at Scottish Power Energy Networks; Aileen McLeod, who is the director of business planning and commercial at SSEN Transmission; Morag Watson, who is the director of policy at Scottish Renewables; and, joining us remotely, Mark Hull, who is the chief technology officer at Community Energy Scotland. I thank you for accepting our invitation. I know that some of you were present during the earlier evidence session, so you will have had the benefit of that.

We are quite short for time so not everyone will be able to answer every single question. For those who are in the room, if I am glaring at you, it is because I want to bring somebody else in and to give everyone an equal opportunity to speak—read no more into it than that. The first questions come from Mark Ruskell.

Mark Ruskell: I want to come back in on dispatchable electricity and some of the challenges in securing a route to market. I will perhaps start with Morag Watson, and if other witnesses want to come in, that will be fine. In particular, I want to ask you about pumped storage hydro and any other technologies with which there

are issues in establishing a clear route to market at the moment.

Morag Watson (Scottish Renewables): I will pick up on what Clare Lavelle said in the earlier session, which is that, when it comes to storage on the grid, there are two issues: the technological issue and how you solve it, and the market mechanisms.

The BEIS flexibility plan says that we need about 30GW of flexibility in the system by 2030. Pumped storage hydro could provide around 10GW of that. It is distinctive to the geology and geography of Scotland. There is a little in Wales, but most of it would be in Scotland. The key reason why we are not reaching investment decisions on it is because we need a finance stabilisation mechanism. These projects take decades to build. I do not know whether anyone saw the BBC news website this morning, which said that the Coire Glas project has £1.5 billion-worth of investment and will create 500 construction jobs. However, that will be over about seven to 10 years, so you need patient finance.

The UK Government put out a call for evidence in 2021 for how it would be done, to which we submitted information on a cap and floor mechanism, which is what is used for interconnectors. The big cables that connect us to Europe would be technology neutral but would work for pumped storage hydro. That evidence was asked for in 2021, and we have been told that the Government might make a decision on it in 2024. The issue is not that it cannot be done, but the timescales for reaching a decision are problematic for industry.

Mark Ruskell: Scott Mathieson or Aileen McLeod, do you want to come in on pumped hydro or any other issues around dispatchable technologies?

Scott Mathieson (Scottish Power Energy Networks): It has been well covered. The only other thing that I would add is that the functional specification of what connects to the grid is important, as well. Renewables can have grid-forming technologies associated with them, and we need to see the commercialisation of things such as virtual synchronous machines at wind farms. Clearly, batteries have a role in balancing this out. We have an abundance of battery applications in the system, but they have to be in the right location and the right area to balance out the system appropriately. As I said, Morag Watson covered it well.

Aileen McLeod (SSEN Transmission): As grid developers, we are technology agnostic, but we are concerned about maintaining security of supply. The Climate Change Committee report that was published a couple of weeks ago and referred to earlier emphasises the resilience aspect of the grid and a focus on technology independently of how it contributes towards security of supply. Long-term planning for the grid and understanding how security of supply will be realised are incredibly important to our keeping the lights on in the future.

Mark Ruskell: I will move on, but I might come back to Mark Hull in a minute. I want to ask about onshore wind. We did not discuss that much with the first panel of witnesses. Morag Watson, how do you think the onshore wind target will be delivered? Are we looking at using existing sites that have already been through planning or those that have been loitering in the planning system for some time? Are we looking at repowering? Is it a mixture of both?

Morag Watson: It is a blend. There is currently a discussion between the Scottish Government and industry on a sector deal on onshore wind. Based on the Climate Change Committee's sixth carbon budget, Scotland will need an additional 12GW of wind to achieve net zero. As an industry, we have already done a project pipeline and analysis of where that will come from. Approximately 12 developers in Scotland will deliver the 12GW through projects that they have in process at the moment.

As I said, it will be a blend. To optimise existing infrastructure, we look in particular at the extension and repowering of wind farms. We either add round the edge or repower what we have; that is the most efficient way, because all the access tracks, grid connections and substations are there already.

The second thing that we look at is clustering. If there are three wind farms in a triangle, for example, it makes sense to fill in the area in the middle. Again, that is about the most efficient use of land, connection, access and so on.

Once that is done, we would start to look at greenfield sites. We will not get to 12GW of additional onshore wind in Scotland without greenfield sites—we will need them. The ideal places to put them are close to centres of population, because, again, that minimises grid cost. However, with the Eskdalemuir seismic array, which is outside Lockerbie, blocking about 10 per cent of Scotland across the central belt, a resolution needs to be found to enable us to unlock development in that area. That could change our current ability to deploy about 2GW in that area, increasing it to up to 8GW, which would be half of what we need to do. That will be important.

Mark Ruskell: That is still a significant blockage. How about the electricity network? We had discussions with the first panel of witnesses

about the Beauly to Denny transmission line and others. How prepared are we to take 20GW of onshore wind?

Scott Mathieson: I am happy to pick up that question first. We are prepared. We have the technologies. We have been working over the past couple of years on something called the holistic network design. There is an abundance of acronyms in our industry, as you know. The HND lays the blueprint to take us to 2030. In effect, it will allow us to increase—more than double—the current export capacity that we have from Scotland.

To put that in context, we can export 6.6GW of renewables on any given day from Scotland via onshore interconnectors and the western HVDC link. We have that in flight, and Aileen McLeod and I are working on two further east coast DC links at the moment. The development of a potential further fourth link before the 2030 horizon will get us to about 15GW of export capacity, which will support the 25GW of additional renewables that are coming on to the system.

Mark Ruskell: [*Inaudible*.]

Scott Mathieson: They are offshore, and they help. We look wherever possible at where we can reconductor, which means putting higher-capacity conductors on existing towers. We are also looking at high-temp low-sag conductors, which is an innovation in conductors that allows us to get up to 30 per cent more capacity out of the network.

The DC links are not without impact with respect to planning and consenting, but they are completely different from overhead lines. By the time that we get into the 2030s and head towards the 2040 target of up to 60GW of renewables from Scotland, we will be back to looking at further onshore upgrades, as well as significant offshore upgrades. We know how to engineer those, so the two biggest challenges that we have in delivering the infrastructure are planning and consenting and supply chains.

Mark Ruskell: I would like to bring in Mark Hull at this point, followed by Aileen McLeod.

Mark Hull (Community Energy Scotland): Basically, the grid experts are in the room rather than here, especially at the transmission scale. Our experience is much more at distribution level. I welcome the identification by Scottish Renewables that it can get the 12GW with 12 large sites.

11:15

I am quite nervous that we are missing an immediate opportunity in gap filling. I agree with Scott Mathieson that some of the biggest challenges are the acceptability of and planning for these things. We have an opportunity to fill a lot of the gaps more quickly with locally and community-owned sites that are on a smaller scale. I am delighted about offshore wind developments and the Coire Glas project, which was in today's news. Those are on the macro and longer-term scales. However, with a driving imperative to decarbonise quicker and to do it up front, we should try to fill in the gaps by taking advantage of the repowering or expansion of smaller sites. We can do a lot of gap filling with greenfield sites to make better use of the distribution grid and have better generation from that point of view. That is a particular area of importance.

In the wider argument of decarbonising in a just and inclusive way, I think that, to some degree, the battle will be won at that level, from the points of view of the absolute generation that we achieve and getting the ownership and people taking responsibility for their network systems. We see the benefit of that when it is closer to home and to the end user.

Aileen McLeod: You asked about network readiness, and the words "inhibitor" and "enabler" are in the inquiry's title. As we sit here today, the grid is an inhibitor. We heard that in the earlier session this morning. Why is it an inhibitor? It is because we do not have enough. I am sure that we can explore that further as the discussion goes on. It is key that it is an enabler. Scott Mathieson described well the plans that are in place, but we recognise that some critical steps must be taken to be able to implement the plans in the near term.

I have a list of three—who does not love a list of three? The first one is about planning. It is not about throwing away all the good things that happen in planning; it is about putting in place a more structured process, with clear timelines, clear roles and a voice for everyone involved, in particular the communities. The Beauly to Denny power line has been mentioned, and we have learned a lot in the past dozen years. We have particularly learned about the importance of engaging early with the affected communities and understanding the impacts. That is not to say that there will not be bumps in the road. I am sure that there will be subsequent inquiries and that we will talk about this further, but it is a critical aspect.

The second one is about commitment, which is key: commitment to delivering the infrastructure and to decarbonising, and commitment to not changing the rules, the direction of travel or the pace. Why do we need that? We are operating in a global environment in which we try to attract technologies, skills and supply chain. That has been mentioned a number of times. We talked earlier about things such as investment in ports

infrastructure. If we get the commitment right, we can bring in inward investment and drive the economy of our country.

The third one is about skills, in which there is a huge opportunity. The draft strategy came with a just transition element to it. We want to transition, in effect, from a high-carbon economy to a low-carbon economy. Doing that in a managed way will require planning for skills development across our whole country so that our young people can see a future and a high-value job through which they can contribute to the social good and social fabric of our country.

Those are my three things: planning, commitment and skills. I will probably say them again.

Mark Ruskell: That is great. I am sure we will keep coming back to those themes.

The Convener: The deputy convener has a supplementary question.

Fiona Hyslop: I want to ask Aileen McLeod a question so that we have it on the record. You said that, currently, the grid is an inhibitor. Can you explain why that is? What would address that?

Aileen McLeod: All the witnesses have talked about the challenges in getting connected. Morag Watson might want to touch on this, too. Connection dates are now extending a decade into the mid-2030s. Why is that? It is because there is insufficient grid capacity. There has also been mention this morning of the level of constraints. The figure that was used by the National Audit Office earlier this month was up to £62 million a day. That is a consequence of not having enough grid capacity. The power that is being generated is, in effect, not able to access the market and flow into homes and to consumers.

That situation has built up over a number of years. There has been, in many people's minds, good reason for that, given that there was uncertainty about the future and that people did not want to spend money on things that might not be required. We see the consequences of that shortage today in the costs for homes, businesses and consumers and in relation to the decarbonisation of our economy.

Morag Watson: It will probably be helpful to the committee if we look at the underlying reasons why we are in the pickle that we are in. In the past, we always had responsive grid development. People had to clearly demonstrate that more grid was needed, and then the regulator allowed them to build it. The grid is eye-wateringly expensive, and the costs get added to consumers' bills, so you never want to build more than you need.

Net zero has entirely changed the game. At no point in the past have we ever had an end point for what we needed our electricity system to do. Net zero creates that end point, but we are trying to plan a grid through a regulation system that is there to control—it is not there to forward plan, to provide development or to be proactive. That is why we find ourselves in this situation.

A future systems operator has been proposed as a remedy for the situation, because that entity could plan for where we need to go, but as we have said, we do not expect to see that for quite some years. The plans for it are bogged down in the Energy Bill in the UK Parliament. We need legislation to be passed before that operator can be created.

Ofgem has some processes. For example, ASTI—I will defer to my colleagues to talk about that process—is about anticipatory investment in infrastructure. However, again, we are asking the regulator, which is there to control, to be proactive. That is not what it was set up to do. That is why we find ourselves in this pickle.

The report from the CCC that was published last week asks whether we can have a stable, secure and affordable net zero grid by 2035. We absolutely can, but not if the current pace of change continues. All the things that we need to make that a reality are happening too slowly.

Fiona Hyslop: Does Scott Mathieson want to add to that?

Scott Mathieson: Yes. I will steal a wee bit from Noam Chomsky's "Optimism over Despair". I would categorise the grid not as the inhibitor but as the catalyst. It is mutually consistent with renewables ambitions, but I absolutely agree with Morag Watson and Aileen McLeod that we have had a decade or more of a regulator resisting anticipatory investments ahead of need. However, it has moved significantly—we can see that signal through ASTI over the past year. Even just a couple of years ago, we were still struggling with the regulator in relation to building ahead of need.

We should try to crack the planning and consenting part of the equation, address some of the major supply chain challenges and capitalise on the economic benefits, as Aileen McLeod characterised it. In our company, there is significant interest in direct current cable manufacturers. We need five major DC cables and hundreds of kilometres of cable to be produced—there is not enough capacity in the world—and those manufacturers want to come to Scotland. There is a unique opportunity through this transition.

We use, I think, a good metaphor. At the moment, we are in a climate change emergency, and we need to treat it as such. We saw what we could do at the height of the Covid pandemic in relation to the vaccine—we were able to create

and produce a vaccine in 10 months, whereas, normally, that would take 10 to 12 years. To crack this, we need that kind of tectonic change to address planning, consenting and supply chain issues. If we can get that level of support, I genuinely think that we can realise Scotland's ambitions.

Fiona Hyslop: We are getting Noam Chomsky in the *Official Report* of the Scottish Parliament.

The Convener: I will bring in Liam Kerr, who has a question about planning.

Liam Kerr: Scott Mathieson and Aileen McLeod have both said that planning is an issue. Scottish Renewables broadly welcomed the new national planning framework 4. Does NPF4 deliver on the planning that is needed, given that you have referred to that as a challenge?

Scott Mathieson: It takes us forward, but it does not go far enough. We need a planning process that has defined timescales. One of our projects is from Beauly to Denny, and our Kendoon to Tongland reinforcement project in south-west Scotland has been eight years in the making. It has been frustrated through a planning process for four or five years, and there were also three years of redesign and changes to accommodate what stakeholders in the area wanted.

That cannot happen if we are to build the DC links. The Scotland to England green link 1—SEGL1—needs to be commissioned and operating to export capacity by 2027, which is just four years from now, so planning consent needs to be obtained by the first or second quarter of 2024.

The problem is not unique to Scotland, so I do not want to characterise it as being about NPF4. There is no point in building a DC link that has consent in Scotland but does not have consent in England and Wales. We have the same problem. There is a development consent order process with defined timescales, but that can typically take up to four years, too.

We need a fairly big systemic change in our approach. That is why I go back to the metaphor that I used earlier. If we genuinely believe that we have a climate emergency, that requires us to authorise and consent to infrastructure in a different way.

There is a proposal for a central networks plan across Great Britain as a whole, so Scotland's infrastructure would be accommodated in that plan. We can begin to think about what role that could play in setting out the benefits, including enhanced community benefits, that the infrastructure could deliver against Scotland's targets. How could it play a bigger role in speeding up the consenting process?

Aileen McLeod: I agree with what has been said. Planning is difficult. At the end of the day, when undertaking a planning process, there needs to be a trade-off with lots of complex factors. Whatever we do, we should not step away from ensuring that there is robust evidential underpinning and that all voices are heard. Some of the things that Scott Mathieson talked about, particularly the community benefits on the grid side, can help with the transfer of costs and the associated benefits.

I highlight that there has been significant progress in the grid sector. Compared with where we were a dozen years ago, our understanding of approaches involving biodiversity net gain and natural capital has developed—it is like chalk and cheese. Scott Mathieson gave an example of involving communities, and I could give similar examples from the north of Scotland of changing designs to address community concerns.

The scale of this is absolutely profound. Earlier, Stuart Haszeldine mentioned having four projects like the Beauly to Denny one. That is what we are talking about in the north of Scotland. We are talking about major infrastructure builds to the north of Beauly, to the east of Beauly and down the east coast. That is in addition to the subsea links down to England, across the Moray Firth and, most welcome, out to the Western Isles, with all the benefits that that will, I hope, bring to that local community. It is absolutely astonishing. We talk a lot about it being equivalent to what happened in the 1950s and 1960s, but the scale of the change is even bigger than that.

Does our current planning system fit with that? It is hard to answer that with a yes, but it is very important that we do not diminish all the good things that happen through planning just now in a rush to reform and move forward.

Jackie Dunbar: Good morning, panel, and thank you for coming along. I am going to ask Mark Hull a question, but any other panel members who would like to add comments should feel free to do so.

Mark, you are probably aware that, as part of our away days, the committee visited the Aberdeen Donside hydro project, which is not in my constituency, and we saw the fantastic work that goes on there. What role do local community projects such as that one have in supplying the current electricity network? How can we harness their potential as we move forward?

Mark Hull: It is a very relevant question. I have been listening to others and trying to think about it from the point of view of infrastructure. I have spent a couple of decades working with communities that are off the grid and thinking about the challenges and the practicalities of that,

but I am also a huge fan of the grid. At a transmission level, it has been really good, and we are well ahead of the curve on it. Having spent the past 15 years wrestling with the distribution grid, I know that it has created a lot more challenges for us in relation to delivering, which is a real shame.

11:30

In general, if we are going to achieve what is needed quickly enough, as we touched on earlier, we will need to look at the distribution grid and local supply. On the opportunities that come from having local ownership and community ownership—this touches on the previous point that was made about planning—beauty is in the eye of the beholder, to some degree. We can genuinely see the difference when people are involved and invested in projects. We could consider the Donside example, but I can also think of many others.

From that point of view, it is nice to hark back to when hydro was first rolled out, in the 1960s. If we are going to succeed, we need to take people along with us. It is not about giving out freebies; it is about people feeling they have some ownership of projects and some stake in them, because in that case they will welcome them. It is a twee example, but people in Orkney will look up to the turbine on the hill and say, "It's our turbine," They smile when they see it. That is the complete opposite of what happens elsewhere. That example may sound twee, but that really does matter if we are going to take people with us and make the change rapidly. It is about acceptability, never mind the wider benefit.

I have an even more twee example from the island of Shapinsay, where the old matriarch of the village was originally very much against a 1MW wind turbine going up in the area. Her granddaughter told her that the community would get 7p every time it went round, and once the turbine had gone up, she got her nephew to chop down a hedge so that she could see it turning. That is a real example and it is a human one. If we have local involvement in infrastructure changes, we will be able to let them happen because we will be working together on them. People will take a stake in projects rather than seeing them as things that are being done to them, in which case they will—at best—object and grumble. I have put that in simplistic terms, but it is key.

Over the past two decades, I have also seen the indirect and second-generation benefits that arise. When people get involved in generation, they also think about other infrastructure, including projects to do with communications, mobility and the harder things that we will have to tackle in decarbonising. We place emphasis on the grid and on the things that we discussed earlier, such as hydrogen, chemical fuels and stores, but they have to be the last resort. First, we need to reduce demand and have energy efficiency, and then we need to make better connections so that we can balance the grid more easily.

Sorry—I lost my train of thought there. There are opportunities when people take on their own generation and local balancing projects and when they take an interest in local demand. However, to enable that, we have to restructure the infrastructure, and not in a physical sense. As one of my colleagues said, it is more to do with contracting and things like that. We need de-risking so that local actors and smaller actors can become involved.

I do not want to go on for too long, but I note that the Western Isles interconnector, which we have talked about, is a really good example. The local population wanted to buy a bit of that large interconnector and create an opportunity to have local generation, but that was prevented in the early stages because the underwriting requirements were too high. The local communities, local organisations and even the local authority could not move quickly enough. The Western Isles will be left with 140MW that will probably get snapped up by one or two large operators, because they are ready to move.

We need to ensure that the contracting system allows for de-risking so that smaller actors with less deep pockets can interact with the process.

Jackie Dunbar: That is really interesting.

I will ask just one more question, because I am conscious of the time. Morag, I asked Stuart Haszeldine how critical it is to the decarbonisation of Scottish electricity for there to be a Scottish CCS cluster. What are your views on that?

Morag Watson: If I may, I will divide your question into two and separate out CCS and electricity.

Currently, depending on the weather and demand, 97 or 98 per cent of Scotland's electricity need is met from renewables. Scotland is more than capable of meeting its electricity needs from renewable energy. Likewise, as we decarbonise transport, which accounts for 25 per cent of our energy use, and heat, which accounts for around 50 per cent of our energy use, we can have sufficient renewable energy generation to meet that need.

On whether we can meet net zero without CCUS, I defer to much greater experts than me, such as Stuart Haszeldine and the CCC. However, all the credible advice that I have read on the subject suggests that the answer is no and that we will need carbon capture and storage. There will be parts of our economy that we cannot

decarbonise using electricity and parts of our economy where we will need the compensatory measures that Stuart talked about, and that is the role that CCUS will play. We will need it, not necessarily in the electricity generation sphere, but certainly in other spheres.

Jackie Dunbar: Scott, do you have anything to add?

Scott Mathieson: About 98 per cent of our supply is from renewables, but SSE owns a plant at Peterhead that helps to make sure that we can balance out the system. There is a transition as we are building out the transmission network that also enables Mark Hull's community schemes. If we look at SP Distribution, about 78 per cent of our grid supply points—the interface between distribution and transmission—are effectively exporting or constrained at any point in time. When we build the bigger superhighway, it also allows greater ambition to be realised at the community levels. That is increasingly important from a resilience perspective in those communities, as well as with regard to the economics.

In the winter that we have just come through, there were points when gas provided up to 40 per cent of the demand. That is the stark reality. If we are going to have periods when we will rely on that, given that we believe that there is a climate emergency, we cannot have it polluting the world's atmosphere, so will need to have carbon capture alongside it.

I say again that I am optimistic. A lot of work is happening in a university just along the road from here—Heriot-Watt University—to look at that. I would like to see more effort in Scotland to look at the industrial clusters for hydrogen and for carbon capture as part of that to make sure that they are in the armoury. Beyond that, however, this is not my area of expertise.

The Convener: We move on to questions from the deputy convener, Fiona Hyslop.

Fiona Hyslop: I direct these questions to Scott Mathieson and Aileen McLeod. Do the current business plans from SSEN and SPEN, in relation to both transmission and distribution, allow for sufficient investment in the networks to realise what is in the draft energy strategy from the Scottish Government?

Scott Mathieson: Our business plan is to spend approximately £14 billion between now and the early 2030s—£6 billion on our distribution networks and £8 billion on the transmission networks. I know that Aileen McLeod's numbers will not be terribly dissimilar.

Our model is highly important here. It spreads out the costs of that infrastructure over a 45-year period. The returns are relatively low and the regulator has pushed them down further at the price control reviews, but we believe they can still attract the necessary inward investment into Scotland.

Ultimately, that means that, for use of the transmission and distribution network, customers can expect to continue to pay about 40p per day. I think that we have the quantum of investment. We also have a number of uncertainty mechanisms in place from the regulator. One thing that it woke up to was that it needed to make the price controls much more agile to allow a surer ambition to accelerate to be able to trigger that money. A challenge that I would put to the regulator is whether it is equipped to process some of those uncertainty mechanisms agilely and quickly in return. We need to see that over the next 12 to 18 months and we need to see evidence of its ability to support our ambition alongside it.

It is important that I say a word or two about what that funding provides. The low-carbon transition is not simply about the high-profile headline transmission network. It is also about ensuring that domestic customers can realise their ambitions with respect to electrification of vehicles and a transition into, for example, electrification of heat. We have to make sure that we address the safety of the electricity network directly within customers' premises. We have significant funding within the distribution price controls to make sure that we upgrade the very low-voltage tributaries that serve the end customer alongside building out the transmission network.

Aileen McLeod: The second of the three points on my list earlier was about commitment. For me, that is at the heart of the questions about the regulatory framework. We saw the change that happened early last year with the shift in the national UK-level strategy that unlocked the big investments that we are now seeing in the transmission system and a shift in the regulatory framework. It is easy to do that when the spotlight is shining and that shift is happening, but we will need to maintain that over the next 10 to 15 years.

We are looking towards meeting the 2030 targets, of which ScotWind is a critical part. I refer again to the huge economic benefits that it can bring us in Scotland and, speaking personally, to the north of Scotland in particular. Beyond that, however, we are looking to decarbonise our electricity system by 2035. A long and sustained effort is required, and that commitment is key.

We have seen a change in the regulator. It has a job to do, and the point that Morag Watson made earlier about control is important. It is acting on behalf of the consumer and making sure that the right decisions are being made. However, those decisions need to be made in an agile way

and they need to take into account the cost of inaction, which we can see today predominantly through constraints around deferrals and uncertainty about the future.

We need a commitment for the long term and a focus on targets. I will not talk more about targets just now, but I could spend an extra five minutes on that. We must all strive towards the same common goal—people in the Scottish Parliament, people at Westminster, the regulator and those of us who are key stakeholders in delivery. We all need to work together towards meeting the targets. If any of us starts to wobble and flake out, that will send a signal to all the parties that are involved and it will probably encourage everybody to take a step back.

Fiona Hyslop: What are the impacts of current delays and deferrals, and of inflation, on your short-term business plans?

Scott Mathieson: At the moment, both companies have spent in line with their overall allowances. That is a pretty remarkable achievement when we look at what competitors south of the border have done. We have seen inflation going up and down; I know that it has been going up over the past year, but not long ago, in 2015 and 2016, inflation was negative. It is swings and roundabouts and it will even out, going forward.

My acute concern going forward is to realise the ambition. I come back to the regulator. I have heard Jonathan Brearley publicly say that he thinks that the regulator did its bit with ASTI last year. Aileen McLeod's point is important: we need to ensure that it continues to do that. We need to get consents at the time when we need them, and we need support in global manufacturing. The UK and Scotland are not the only places that are building major transmission infrastructure. Holland and Germany are doing the same and are placing contracts out to 2037. Our regulatory framework does not support that at the moment; we need planning and consents and we need more resources in the UK so that we can continue to spend in line with the projections that we have made.

Fiona Hyslop: The committee can address those issues with Ofgem, when we see it. I am conscious that a number of the issues are reserved, so I will focus now on the Scottish Government and come to Mark Hull. What more could the Scottish Government do to support network investment and readiness?

Mark Hull: Oh, crumbs.

Fiona Hyslop: I will ask the same question of Morag Watson, so I will give you a bit of time to think, Mark.

The Convener: I am confused. Is Mark going—

Fiona Hyslop: Mark, do you want to answer that question?

The Convener: You have no time to think, Mark.

11:45

Mark Hull: On the opportunity, so much of it is [*Inaudible*.] which makes it tricky from the point of view of aligning with Ofgem. On making a needs case and providing support, especially at the lower-voltage level and user level, we have a decarbonisation plan for domestic heat, mobility and so on that makes that case. It makes the argument that, especially at distribution level, we need to rapidly reorganise. It is not just about wires and cables; it is also about the challenges that SPEN and SSEN will face when there are a huge number of heat pumps.

I want and welcome electrification, where possible, of most of our heat and mobility, although it is the second resort, with energy efficiency still being the first resort. We will face a challenge in dealing with people on networks. SPEN kindly applied to Ofgem last year for further provisions to use local trusted partners and community anchor organisations to help to roll out things like heat pumps, and to help with the challenges that we will have in getting people to adopt and use the new technologies, and in getting them used efficiently in the community. Such things help in the interaction between the UK and Scottish Governments in helping, at the same as making the national case, their individual citizens to decarbonise and to live affordable good lives. That is one opportunity that I can think of, straight off.

Fiona Hyslop: Thank you. On stimulating demand, are you saying that the Scottish Government has a role?

Mark Hull: Yes. It is mostly about stimulating demand and making the case. I will stick with that.

Fiona Hyslop: Morag Watson, what would you ask of the Scottish Government to support network investment and readiness?

Morag Watson: My network colleagues' work will be based on the future energy scenarios and similar systems, which is how the needs case is made for what will be needed in the future. To pick up on what Emily Rice from Solar Energy Scotland said earlier, I note that setting of targets gives a clear signal for what will be done that feeds into future energy scenarios, and it allows my colleagues to put a case on that to Ofgem. That is helpful.

Planning has come up at various points. I have said it in Parliament before and I will say it again: the NPF4 is probably the best planning regime for renewables in the whole of Europe. It is to be commended, but it cannot do the entire job alone.

One key issue is that there is no set format for how to put in a planning application either for renewable energy development or for grid infrastructure development. The lawyers tend to be cautious, as lawyers are, and say, "Put in everything." Because the decision-makers have no clear framework for what to ask for, they will get nervous and ask for more in order to make sure that they have covered everything. We end up with bigger and bigger piles of paper to deal with, which then puts a huge strain on the whole system. The fact that every application turns up looking entirely different from the one before it means that people cannot build up expertise in where to look, in the great big pile of paper, for what they need to know.

We are in discussion with the Scottish Government on a standardised format. We have been doing this stuff for 20 years and we have been doing grid infrastructure for longer than that. We should be clear about what decision makers need to know in order to make an effective decision. We could do a lot of streamlining to cut the huge timelines; that is a key thing that the Scottish Government could look at.

Fiona Hyslop: Thank you. Aileen and Scott, briefly, do you agree with that?

Aileen McLeod: I do. Resources are critical. A lot of people from a lot of authorities are involved in the planning process and in making sure that is adequately resourced. There can be asymmetry in terms of resources, when perhaps the applicant has resources and it overwhelms the parties that have to deal with applications.

The Convener: Scott Mathieson, do you want to say something briefly or just say you agree?

Scott Mathieson: I do agree. I have to belabour planning again. We have an opportunity for massive growth in the workforce right across the supply chain. That requires support from and effort by the Scottish Government with local colleges—from loop work, to low voltage infrastructure, to new apprentices all the way up to senior engineering roles. We have high-quality jobs at every level and we have jobs that one would not necessarily think about in the stuffy conventional network businesses. They include data scientists, customer service professionals, and finance and commercial roles. There is real potential.

Liam Kerr: I want clarification of something that was mentioned earlier. I will put this to Scott Mathieson and then Aileen McLeod. Scott talked about regulatory frameworks. My understanding is that Ofgem will set price controls that will regulate how much Scottish Power and SSE can spend on investment and innovation during a particular period. I understand that both transmission and distribution are in the regulated periods until 2028. What scope is there to alter your investment plans in response to changing circumstances, changing technologies and changing priorities during those regulated periods?

Scott Mathieson: We are now in the second year of our current transmission review. The regulator gives us two categories of expenditure. One is a baseline expenditure based on realistic forecasts that we put forward. Some of that expenditure will be on replacement and modernisation of an ageing asset base. Remember that a lot of the infrastructure was built between the 1960s and the 1990s and needs to be replenished, modernised and brought up to modern standards, to provide the increased capacity to meet the load growth that we are talking about.

We also have significant uncertainty mechanisms to allow us to respond and apply to the regulator for further funding. For schemes that are greater than £100 million, there is now the new ASTI framework, which was previously the large onshore transmission investment, or LOTI, mechanism. As I said, there is an abundance of acronyms. We had to submit a needs case for anything over £100 million; that process included a fairly laborious initial needs case and final needs case. ASTI changed the nature of that to make it much more agile for the regulator. The focus is on support from the companies. The TOs and the plans that we submit were endorsed by the electricity system operator, which then works with us during project assessment on going to tender for the contract to make sure that we are still efficient and are doing all the right things.

For projects below £100 million, there are medium-sized project mechanisms that we can access. There are probably a significant number of projects. In January, I submitted to the regulator 12 reopeners for medium-sized investment projects for it to process. On the point that I was making earlier, if our colleagues up at Scottish Hydro Electric Transmission and National Grid down south are doing the same, is the regulator equipped to process those quickly enough to give us a decision and let us get the investment out the door?

Again, I note that the regulator maintains that no sector is as heavily scrutinised by a regulator. For our transmission business, every July we submit 1.5 million data points down to the lowest level of materiality. We publish our accounts and the returns that we make in detail to make sure that in everything that we do when we apply for

reopeners, bills ultimately come back to the level that the regulator expects for the consumer.

Liam Kerr: I am grateful. Aileen, would you like to add to that, or is your answer similar?

Aileen McLeod: It is. The quantum of work that we put on the desk of the regulator is equally large. We planned within this current five-year period to put forward 46 separate requests for funding for transmission, which range from a couple of million pounds up to a couple of billion pounds. That is the scale we are looking at.

You referred to things changing as we go; a lot of change is happening in our industry, in our economy and in our society—you name it—within those fixed periods. When we engage with our stakeholders and our communities, we see that they are looking for us especially to take into account environmental, community and other impacts when we prepare investment decisions. That is right and appropriate.

Ofgem is an economic regulator and has tended to underweight those broader considerations. It has tended to underweight in particular the benefits of economic development that can flow to a community and to the economy as a consequence—the indirect benefits, if you like. We will, going forward—this might relate to the questions around Ofgem's duties—take into account broader factors than just purely economic considerations when making investment decisions, but we will not do so more slowly, as a consequence.

Liam Kerr: I understand. I am grateful, thank you.

The Convener: Thank you very much, Liam. Monica Lennon has questions. I will cheekily say to you that I will not interrupt you until just after 12, then I will interrupt you.

Monica Lennon: That is okay. A lot of what I wanted to ask about has been addressed in the answers that we have had so far.

I want to focus on community energy. This question is for Mark Hull. We know that the Scottish Government aims to more than double the amount of community-owned energy and locally owned energy to 2GW by 2030. You have already said what some of the key challenges are and have mentioned the current electricity network. Is there anything else that you want to say about the key challenges and in what way the sector is inhibited by the current electricity network?

My other question—I might aim this at you as well, Mark—is about shared ownership. The Government wants to "encourage" shared ownership models. Is it enough for the Government simply to "encourage" such models or does there need to be a more formal mechanism to implement that?

Mark Hull: The first element relates to what I was saying earlier. When we had the feed-in tariff in play 10 to 15 years ago, we were very much hitting up against the infrastructure challenges. As that fell off, there was a lull on that side and there has been less of a challenge in that respect. As we now face a situation in which, almost sadly, the wholesale price is going up again, such smaller-scale projects are starting to look economically viable, and we will face exactly the same infrastructure issues that we faced a decade ago.

I see the Scottish Government having an important role to play. Its 2GW target is welcome. I think that, with good community take-up of that responsibility, we could easily double that. There is an opportunity there—we have the ambition and the sites that would let us double that, but we will hit the grid issues. A lot of the problem is to do with the way that the system is set up. The issue is the securities and the liabilities that let smaller players get part of the larger infrastructure reinforcements so that they can have a seat at the table and have a stake in it. We will often express interest but that will fall off as the price becomes too high for us to continue to be part of those reinforcement strategies.

There is an element of de-risking. The Scottish Government did that well previously in the early stages of the community and renewable energy scheme—CARES—project, when it was able to provide support at risk early on, at the pre-permit stage, that was then either paid back or that became part of the socialised benefit once the projects were built out. That is a big chunk of it.

Encouraging shared ownership is well and good, and shared ownership is welcome, but I think—[*Inaudible*.]—with what we have offshore, we would not want to turn down the opportunity of shared ownership. I feel that community benefit is the benefit that you get from proportionate involvement, where the community takes responsibility and gets reward for that through whole ownership or proportional shared ownership. Owning and making use of the funds is key, but we cannot just encourage it.

Our experience over the past two decades is that there is a risk, to give the classic example, of golden window boxes, where people just do not know what to do with their money. About a decade ago, we had the opportunity with the forestry estate, and work was done by the previous minister, Fergus Ewing, on how to provide better shared ownership opportunities. It is key that we enable an organisation to enter discussions. Basically, we are taking non-technical people into a technical world. Am I not coming through?

Monica Lennon: I am watching the clock, because the convener caught my eye. We are just about to run out of time.

I have a quick final question. You might not know a lot about this. North Ayrshire Council has told us that it takes a community wealth building approach, and we have heard about its work on solar energy. The Scottish Government has committed to introducing a community wealth building bill. Do you see that having an enabling role? Are there any opportunities there for community energy and local energy?

12:00

Mark Hull: Absolutely. North Ayrshire Council is probably a very good example. Even now, it has set aside a fund of about £300,000 and is looking at the best way of using that to enable communities. We have been in discussion with it about that. That is exactly what I am talking about. It is not simply a case of encouraging people; we must enable them. We need to set people on the right track so that they can take advantage of the situation. That applies not just to small communities, but to communities of quite a large scale. We need active and positive enablement more than just encouragement.

Monica Lennon: That is great. Thank you.

The Convener: The deputy convener has one follow-up question, after which I will ask a final question.

Fiona Hyslop: This is a short inquiry on a massive area, but it gives us a chance to put the spotlight on our electricity infrastructure. Is there anything that you wanted to tell us today that you have not had the opportunity to say?

Morag Watson: It has been touched on that Ofgem has an ambiguous relationship with the achievement of net zero, which is not in its primary legislation and how that plays out. The UK Government's energy white paper said that the strategy and policy statement was due to be consulted on in 2021, but we have never seen hide nor hair of it. That is the mechanism by which the UK Government can indicate to Ofgem the policies and strategies that it needs it to pay attention to. It is a mechanism through which we can get Ofgem involved in net zero without having to go back through Parliament to amend primary legislation. We would very much like to see that come forward, so it would be helpful for that issue to be raised in any discussions that the Scottish Government has with the UK Government around its achievement of net zero.

Fiona Hyslop: Aileen McLeod?

The Convener: I am sorry—I will limit you all, because it could be an endless list. If you could each tell us one thing, that would be brilliant.

Aileen McLeod: You will be pleased to know that I had only one thing to tell you. It relates to the setting of targets, which has been touched on a number of times today, and the importance of targets being set in a joined-up way. Targets can be set for technology, for the number of jobs, for economic benefit or for environmental impacts, but if they are set in isolation, they can end up contradicting one another. When targets are set, an important step is to check that they are all mutually compatible.

From that perspective—Morag Watson talked about this earlier—when we look to do planning, having targets that are coherent as a whole gives a lot more confidence in the planning process, which then feeds through into the development, the planning consent, the delivery and so on.

Scott Mathieson: That is the key theme here. I have often wondered how the regulator is compelled to adopt the targets of the Climate Change Committee or the Scottish Government. We have struggled with that, and that feeds into an earlier theme that my colleagues identified—that of how that is encapsulated in the evaluation framework when they come to make their decisions. If we can get that linkage formalised to a greater extent, that will help with the regulatory decision process.

Fiona Hyslop: Do we have time to hear from Mark Hull?

The Convener: Yes.

Fiona Hyslop: Mark, is there anything that you wanted to tell us that you have not been able to?

Mark Hull: Yes. I come back to the issue of recognition of the power and value of local content in community ownership. We have heard about this from a planning regime point of view, but even in a hard grid infrastructure sense, there is a lot of emphasis on the macro scale. However, given that more than half our power will need to be balanced at a local level, we need to make sure that we enable that at a low voltage in distribution. To do that, we need to make a new system. We need to make the infrastructure smart, but we also need to enable people to interact with that market.

The Convener: Thank you. I will now ask my question. A book that I read when I was younger and which I still look at is "The Dam Builders—Power from the Glens", which is a great book. It talks about Scotland's transition to using renewable energy in the form of hydro pump storage and all the rest of it, with massive dam building. As a result of that, we transferred power to the areas that needed it along what were then

superhighways. Scotland's countryside has been shaped by those superhighways that were put in in the 1950s—the 132kV lines. They were obviously built there for a reason, because that was probably the best route and the most protected route.

Aileen McLeod and Scott Mathieson have talked about planning and the difficulties of it. Because those lines are already there, one way to avoid planning problems would be to make sure that those lines are upgraded, without moving them, and that they form the basis of the superhighway in the future. Is that not a simple answer?

Scott Mathieson: I hope that I picked up at the start the fact that we will seek to exhaust all opportunities to uprate existing infrastructure. In my business in the central belt of Scotland, we look to do that. I highlighted earlier, for example, that we have an export capacity from Scotland of 6.6GW. More than 2GW of that was delivered not by building any overhead line, but through innovations such as series compensation, reducing the reactance in overhead lines and uprating some of the power corridors.

However, the Pareto optimality rule can only take you so far before you get into building infrastructure, but those corridors will probably remain the most appropriate, given the geology and location of them.

The Convener: Aileen, you will appreciate that the Beauly to Denny line went from 132kV to 400kV along almost exactly the same route. That seems to be sensible. Once it had been agreed that it would go along the same route, planning became easier, did it not?

Aileen McLeod: Yes. That was in January 2010—I remember it very well. Like you, I look back on what happened in the 1940s, 1950s and 1960s. There is a lot for us to learn from that. I look back at the Hydro-Electric Development (Scotland) Act 1943, in particular, and the commitment within it around bringing economic development to the north of Scotland and stopping depopulation after the war. I think that that runs through what we are trying to do now as well.

What you say is absolutely right. It is not the intention here to put up new lines on greenfield sites, much in the way that Morag Watson described earlier in relation to the development of onshore wind. I will give you a couple of examples. You have referred to the Beauly to Denny project, which involved an uprate to 400kV. At the moment, one side of that is still operating at 275kV. Part of the network investment that we are making for 2030 will be to uprate that to 400kV, so there will not be overhead line investment in order to realise that greater capacity.

Similarly, we are in the process of developing an overhead line reinforcement out to Skye, which will not only unlock decarbonisation but significantly improve security of supply on the island and out towards the Western Isles. We are reusing the same route there as much as possible, and we will be taking down the old line once we have built the new one. Wherever we can do that and whenever we can use new technologies, that is our first resort.

The Convener: I have been involved in the Skye project on behalf of constituents over there, and you and I well know the problems that have been faced, but it seems that it is moving forward.

I thank our witnesses very much for the evidence that they have given this morning, which has been extremely interesting. I suspend the meeting until 12:11, to allow the witnesses to leave, so that we can go on to our final agenda item in public.

12:08

Meeting suspended.

12:11

On resuming—

Subordinate Legislation

REACH (Amendment) Regulations 2023

The Convener: Item 3 is consideration of a type 1 consent notification sent by the Scottish Government relating to a proposed United Kingdom statutory instrument, the REACH (Amendment) Regulations 2023. The UK Government is seeking the Scottish Government's consent to legislate in this area. The committee's role in relation to type 1 notifications is to decide whether it agrees with the Scottish Government's proposal to consent to the UK Government making regulations within devolved competence and in the manner that the UK Government has indicated to the Scottish Government. Are there any comments?

Mark Ruskell: As you have noted, this is a type 1 notification, so it relates to a significant change in the regulations. I noted that the regulations in effect delay both the registration and the compliance deadlines for a number of years. For one category of chemicals in particular, they delay compliance checks until 2035. That has raised some quite significant concerns, particularly at the Westminster Environmental Audit Committee during its scrutiny of the regulations. It is important that we hear from our Scottish minister about this, particularly about whether it represents divergence from the existing European Union registration, evaluation, authorisation and restriction of chemicals—REACH—regulation.

I would also like to understand a bit more about what the alternative transitional model is that is evolving for the development of our chemicals regulation in the UK and how that has worked in relation to the common framework for chemicals and pesticides that our ministers are directly involved in with their counterparts across the UK.

There are some questions here for the minister and I think that it would be a great service to the committee if she could appear before us.

Fiona Hyslop: I am very conscious of the tight timescale for this, but I also want to emphasise the importance of regulation of chemical substances and the importance of the chemical industry to Scotland. This is an area of key importance. It would be beneficial to hear from the minister, and perhaps, if we have time, to write to the relevant regulatory bodies in Scotland to get their perspective on this. It looks as if this is an essential step, but it would be worth drilling down to the extent that we can during the time that we have.

The Convener: Thank you. If there are no other comments, on that basis, I propose that we invite Màiri McAllan to come to the meeting next week and give a short bit of evidence to explain the situation. I will also ask the clerks to write on behalf of the committee to the regulatory authorities to ask whether they would like to submit any evidence. That evidence might be difficult to gather in the timescale, but I will give them the deadline of Monday morning next week, so that we have time to consider it before the meeting on Tuesday. That is a logical way to deal with this so that we can fully understand it. If everyone is agreed on that, that is what I will progress to do.

Members *indicated agreement.*

Water and Sewerage Services to Dwellings (Collection of Unmetered Charges by Local Authority) (Scotland) Order 2023 (SSI 2023/52)

12:15

The Convener: We have one more item, which is the consideration of a negative instrument. This instrument is laid under the negative procedure, which means that its provisions will come into force unless the Parliament agrees to annul them. No motions to annul have been lodged. Do members have any comments on the instrument?

I have one question. I assume that this is done each year. It would be useful to know whether all the money that is levied is collected and whether there is a difference between the levy amount and what is passed to—I assume—Scottish Water. If the committee is happy, we could just write to the minister to ask for that information, so that we can understand what it is. If there are no other comments, is the committee happy to agree that it does not want to make any specific recommendations in relation to this instrument?

Members *indicated agreement.*

The Convener: Thank you all. That concludes our public meeting and we will now go into private session.

12:16

Meeting continued in private until 12:37.

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