ECONOMY, ENERGY AND TOURISM COMMITTEE

Wednesday 26 November 2008

Session 3

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ECONOMY, ENERGY AND TOURISM COMMITTEE
23rd Meeting 2008, Session 3

CONVENER

*Iain Smith (North East Fife) (LD)

DEPUTY CONVENER

*Rob Gibson (Highlands and Islands) (SNP)

COMMITTEE MEMBERS

*Ms Wendy Alexander (Paisley North) (Lab)
*Gavin Brown (Lothians) (Con)
*Christopher Harvie (Mid Scotland and Fife) (SNP)
Marilyn Livingstone (Kirkcaldy) (Lab)
*Lewis Macdonald (Aberdeen Central) (Lab)
*Dave Thompson (Highlands and Islands) (SNP)

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Alex Johnstone (North East Scotland) (Con)
Jeremy Purvis (Tweeddale, Ettrick and Lauderdale) (LD)
David Whitton (Strathkelvin and Bearsden) (Lab)

*attended

THE FOLLOWING GAVE EVIDENCE:

Dr Richard Dixon (WWF Scotland)
Andrew Haslett (Energy Technologies Institute)
Colin Imrie (Scottish Government Enterprise, Energy and Tourism Directorate)
Professor Jim McDonald (University of Strathclyde)
Maf Smith (Sustainable Development Commission Scotland)

CLERK TO THE COMMITTEE

Stephen Imrie

SENIOR ASSISTANT CLERK

Katy Orr

ASSISTANT CLERK

Gail Grant

LOCATION

Committee Room 3

Scottish Parliament

Economy, Energy and Tourism Committee

Wednesday 26 November 2008

[THE CONVENER *opened the meeting at 09:33*]

Energy Inquiry

The Convener (Iain Smith): Good morning, colleagues, and welcome to the 23rd meeting in 2008 of the Economy, Energy and Tourism Committee. We have received apologies from Marilyn Livingstone, who is not well; we wish her a speedy recovery. I remind everyone to switch off their mobile phones and BlackBerrys rather than just switch them to silent, because they can interfere with the sound system. I see the sound engineer nodding appreciatively.

Agenda item 1 is our second round-table discussion as part of our energy inquiry. We will focus on scenario planning. We want our witnesses to tell us about the possible, probable and even preferable scenarios for energy supply and use in Scotland, how we can get to where we want to be, and the critical decisions that the Government and the regulatory bodies need to take.

I ask our guests around the table to introduce themselves and to make some introductory comments. This week, I shall go clockwise and invite Jim McDonald to speak first. The table is not actually round—it is rectangular, which makes it slightly harder to read people's names. However, I have a note of them, so I should be able to tell who is who.

Professor Jim McDonald (University of Strathclyde): I am from the University of Strathclyde and am chairman of the Scottish energy technology partnership, which the committee knows well. It is a consortium of research-intensive energy universities in Scotland that is well connected to Scottish Enterprise and the rest of the public sector. It pushes the energy agenda in research and technology in Scotland. I am also deputy principal for research and technology at the University of Strathclyde. For my sins, I will become principal of that university on 1 March.

The Convener: Do you want to make any introductory comments?

Professor McDonald: Some months ago, I attended a Royal Society of Edinburgh engagement with the committee at which we presented descriptions of a broad range of energy technology in relation to networks, carbon capture and storage, renewables and demand-side technology. It was important for us to engage with the committee to raise awareness. I know that there is plenty of know-how in the committee, but that engagement gave a sense of the dimensionality of the challenge and of how we should choose low-carbon technologies for the future while considering sustainable electricity production. We talked about that in particular.

I and one or two of my colleagues hope that, in discussing carbon management and energy, transport will be touched on, because of the breadth of that issue. Transport and heat account for around two thirds to three quarters of our energy requirements, so we should touch on it.

Following our previous meeting, the RSE did some homework for the committee. We collated a variety of data sources to try to declutter things, because one problem that we have found in presenting our work to the committee has been that many opinions exist on percentages of contributions from renewables and fossil fuel sources, and on demand profiles. At the very least, I hope that the RSE and the energy technology partnership have provided clarity for the committee. As I said to Chris Harvie informally before the meeting, perhaps we can discuss continued support for the committee to ensure that it has valid independent thinking on data sets and options that might come before it, so that it is confident that its information is legitimate.

The Convener: Thank you for that.

I welcome back Colin Imrie.

Colin Imrie (Scottish Government Enterprise, Energy and Tourism Directorate): Thank you very much, convener.

The Scottish Government has a contribution to make to the discussion through material that we have prepared. The three studies that were published on 14 November—I gather that members have links to them—can contribute to the debate. Of course, the challenge with scenarios is that they illustrate what might happen, but they will not necessarily provide a clear picture of what will happen. A particular difficulty with them is that they are based on evidence from the time that they were commissioned, but evidence changes.

I will say something brief about the studies. Volume 5 of the Scottish energy study series considers the prospects for future energy supply and demand in Scotland using two scenarios—one basically involves energy costs following a predictable trajectory; the other is based on high energy costs. It is important to stress that the scenarios were commissioned in early 2007, but because of the time that it takes to produce such

scenarios, they do not take into account the United Kingdom renewable energy strategy or the Scottish Government's renewable energy framework, which significantly changed perceptions.

In the scenarios, in the parallel document on mitigating climate change that was published on the same day and in the document on grid stability in the light of increased renewable generation, there are clear messages about the importance of carbon capture and storage if coal is to remain an important part of the generation mix. As Jim McDonald has said, energy generation is only one factor; it is clear that transport, energy demand and the issue of households delivering many of the expected savings are also important. Of course, the latter will need to be worked on—things can even be accelerated if energy efficiency is given greater emphasis.

The UK renewable energy strategy is proceeding on the assumption that Scotland will remain a major exporter of electricity. It is at the moment—that is the way the national grid works—and the expectation is that Scotland will continue to export electricity into England. The UK's renewable energy strategy, which parallels the Scottish document, expects Scotland to remain a major exporter. National Grid is working on plans for transmission upgrades to strengthen and increase the capacity of interconnectors, which could be done using the current interconnectors or using subsea grids. The scenarios that have been published are important, but we are in a changing landscape, where renewables and other forms of generation are all important.

One of the important messages from the UK renewable energy strategy, the Scottish renewable energy framework and parallel documents such as the draft guidance on applications for thermal power stations, which we published last week, is that providing a stable basis for investment is key to delivering Scotland's future energy supply, whether that investment is in renewables or elsewhere. The fact that the UK Government has reinforced that aspect strengthens the investment potential—the same applies to thermal generation. Alongside the documents, which we hope are a valuable contribution to the debate, the latest developments also help to shape the way in which things will develop.

I am happy to contribute further.

Andrew Haslett (Energy Technologies Institute): I am here today to represent my chief executive officer, who is on holiday, unfortunately. I am strategy director of the Energy Technologies Institute. The institute is approaching its first birthday, on 10 December, I think. No—that is my granddaughter's birthday; it is 12 December. We have spent our first year building the organisation and developing our first projects in wind and marine technology. Our role is to develop the technology and think about policy and market issues, some of which were mentioned by the gentleman who has just spoken.

We are not so concerned about scenarios, although we are very interested in them, as they give us potential contexts in which the technologies will be deployed. We think more about how systems might be designed and what technologies and innovations will be required to make heat, power and transport services available in a way that is affordable, secure and, in particular, low carbon.

Our thinking timescale goes to 2050 and beyond. If we are to make major technology innovations and deploy them on the sort of scale that requires the degree of investment that we are discussing, it will take a huge period of time. The lives of some of the assets involved are of the order of 40 or 50 years so, although 2050 seems like a huge length of time away, some of the decisions that we are making and some of the actions that we are taking today will strongly influence the outcome that we will achieve in 2050.

From the evidence that has been submitted to the committee, I highlight heat and efficiency in buildings as a particularly important area for discussion on the demand side. As transport is a huge consumer of energy and producer of CO_2, that area also requires discussion. We have talked about Scotland's role and its high level of natural resources, which makes it a very important part of the UK energy scene.

I am pleased that the evidence that has been submitted includes some discussion of infrastructure issues. Infrastructure often gets neglected, although it is critical for the integration of the whole of the energy system.

Dr Richard Dixon (WWF Scotland): I am director of WWF Scotland. WWF is the largest environment group in the world, operating in 100 countries, both on the ground, with our traditional conservation projects, and at a policy level.

Climate change is the biggest issue for us. We are working on climate change at global, European, UK and Scottish levels, particularly on the policy side. At the global level, we are very much engaged with the United Nations process. We will have a big team at the UN conference in Poland over the next two weeks.

We have done an energy scenarios report, which considers where global energy will come from by 2050. It deals with all sources of energy, not just electricity. It considers a growth in energy demand by a factor of two—a doubling by 2050—and asks how we might supply that energy. From

our global work, we conclude that there is enough energy out there, and enough possibilities for energy efficiency, for us to meet the rising demand without resorting to nuclear, and to meet that demand while producing the right kind of reductions in climate change gases. I hope that that is a heartening message about the global picture.

09:45

At the European level, we have been working in particular on energy efficiency, renewables and the barriers to electric vehicles. At the UK level, we have been helping to encourage the UK Government to be as ambitious as the Scottish Government and to put an 80 per cent target into the UK Climate Change Bill, which has now happened. We have also been doing technical work on how the target might be delivered, particularly through the energy system, asking how the energy system can contribute to the 80 per cent target.

At the Scottish level, we produced "The Power of Scotland" about two and a half years ago, which considered electricity supply scenarios in particular. The report was done jointly with RSPB and Friends of the Earth. The work is only two and a half years old, but there are interesting lessons on how terribly quickly things can move. A graph at the end, the bands of which show where electricity will come from, shows coal disappearing rather faster than we now expect it to, and nuclear disappearing perhaps five years earlier for Hunterston. In the graph, we are perhaps underoptimistic about renewables when we consider what committee members have heard and the talk that is going on in the industry. The only thing that is perhaps not moving as it should be is energy efficiency, as usual.

More recently, we have been working on housing retrofits. Part of our contribution on the energy efficiency front is to work with others on saving energy in existing buildings. About a third of our CO_2 emissions come from existing homes, so we are concentrating on homes. We have produced a report on a plan for an 80 per cent reduction in such emissions by 2050. The report also covers tackling fuel poverty.

Volume 25 of the "Scottish Energy Study", which Colin Imrie mentioned and which came out recently, contains an interesting graph, showing where we are using energy. We have already heard that we should not forget about transport or energy efficiency. From the graphs in the report, 2008 is probably the year in which transport overtakes domestic as the biggest single sector of energy use. This is the year when the picture changes. Transport has raised its head so far that we cannot possibly ignore it when we are thinking about energy.

Maf Smith (Sustainable Development Commission Scotland): I am the director of the Sustainable Development Commission Scotland. The SDC is a UK body, but I head a team that advises the Scottish Government on sustainable development.

Over the past few years, we have done a number of pieces of work relevant to this debate. A few years ago, we did a report entitled "Wood fuel for warmth", which looked into heat energy through biomass in Scotland. We have also done UK reports on wind, nuclear and tidal power and a review of the Office of Gas and Electricity Markets, its duties, and how it delivers sustainable energy.

Today, we have published our second assessment of progress by the Scottish Government. I will highlight a few points. There has been good progress in renewable energy and many other issues relating to sustainable development. However, we have concerns about energy efficiency, the linked issue of fuel poverty, and rising transport fuel use and emissions.

On scenarios, I echo what has been said about this debate not being about electricity. All of us can be guilty of defaulting back to electricity, which is the smallest of the three main energy issues. That said, we will have to consider the future proportions of the three. There might be options for changing, and it is likely that we will have to change. From the widely differing scenarios that I have seen, it might be that electricity is the one that has to increase the most. However, whatever we do, we will have to consider the sources of energy and ensure that they are reliable and low carbon. That will be a challenge.

We will require a stronger infrastructure and we will have to consider demand management—both in terms of reducing demand among users, and in terms of having a system in which supply and demand are integrated. Our review of Ofgem's regulation showed that they are not. The market does not send the right signals out to people.

In new technologies, we have to consider hydrogen and carbon capture, but we have to be realistic about the timescales and about how we can turn possibilities into practical realities. We should not make assumptions about what might happen. We should think not about what might be installed in the new plant but about what can be installed and how that can help us to meet our energy needs today and in the future and our associated carbon emission reduction demands.

The Convener: As Colin Imrie mentioned, last week saw the publication of a series of Scottish Government reports on future energy scenarios. Depending on various scenarios, they predict that,

by 2020, there will be a fall of between 4 and 6 per cent in energy use, a reduction in CO_2 emissions of between 13 per cent and 18 per cent, and an installed renewable energy capacity of 8GW to meet the 50 per cent target. Do members of our panel think that the scenarios that will deliver all of that are possible, probable or simply preferable?

Dr Dixon: The reports are good, solid pieces of work. However, as Colin Imrie acknowledged, that work was done some time ago, which means that a number of aspects might be somewhat out of date. Colin Imrie mentioned the Scottish Government's renewable energy framework and the UK Government's renewable energy strategy, which are good steps forward—I am sure that he will tell you more about those. One of the key pieces of the strategy and the framework involves the European targets for renewable energy. However, the Scottish energy study does not reflect the 20 per cent renewable energy—not just electricity—target to which Scotland is now committed. That is a significant push forward.

Another interesting issue is the fact that the Scottish Government's reports are based on an oil price of around $50 or $60. Although that is roughly the price of oil today, the average price of oil for this year will probably be around $80, and the price will go back up again once the recession is over. The world that the reports picture is probably not much like the real world, as the oil price is likely to be pretty high in the run-up to 2020. That might mean, for example, that there will be a major rethink on how much oil we are using in the transport block, as we might be incentivised to go for alternative transport fuels, such as electricity.

The reports give us an interesting baseline. The targets are definitely achievable, but we should attempt to go beyond them—there are already plans in place that should result in that happening.

Professor McDonald: I endorse what Richard Dixon has just said. Given that we have balanced the transport and heat argument, I will return to the electricity argument. Is the 8GW target desirable? Absolutely. Is it probable? It would be more probable if we aligned some planning and investment strategies in the relevant policy instruments. We can achieve that target—and, perhaps, go beyond it—by 2020 if we grasp the nettle of the infrastructure question, which Andrew Haslett raised earlier.

Releasing Scotland's potential will involve renewable technologies, both onshore and offshore—those are coming along, as marine power is about a decade away from realising its potential. However, we have to bear in mind some worrying statistics about infrastructure. Much of the network infrastructure is 1960s and 1970s vintage, and the distribution level infrastructure is even older than that. If we are going to reach the 8GW target, we will have to look to offshore sources. Given the planning period and the need for the investment of the tens of billions of pounds that we need to build those electrical highways, we need to start work now. We cannot go too far into the next decade without making major decisions about the grid infrastructure in Scotland. In that regard, it is important to think about Scotland's grid in the context of the UK and Europe. The decisions that we make in Edinburgh must be made alongside those that are made by partners in London and, increasingly, Brussels. That will enable us to work with the utility companies, the original equipment manufacturers and the major developers in a way that will take us beyond 2020 and 2050.

There are local challenges that have to be met if we are to realise our potential as a renewables powerhouse but, increasingly, we will have to raise our game to meet challenges outside our borders. By doing that, we can provide leadership with regard to the architectures and technologies that we need in order to deliver on some of the Government's policy targets.

Andrew Haslett: The scenarios are entirely possible and are consistent with some of our ambitions and targets. However, as Professor McDonald said, whether they are probable depends on whether we are able to identify the specific things that need to be done. There is very little time. If you look into the evidence that is available about people's expectations and plans, you will see that it is not at all clear that the environment in which those things will happen is present. That is quite a big issue for a lot of people.

Lewis Macdonald (Aberdeen Central) (Lab): Could you expand on that?

Andrew Haslett: We do not do a diagnosis of the policies or of the economic environment for actions today—that is not really our area of expertise. However, we have to judge what the trajectory of the steps that will be taken is likely to be in the short term. If assets are put on the ground in the next 10 years, there will be a different starting point for the following 10 years, and so on. Therefore, we consider things such as published reports by National Grid on connection requests. Such evidence causes us concern, as there is less visible commitment of finance to do some of the things that we might expect to see being done in order to deliver some of the targets that we have discussed. We are not in a position to comment on why that might be, but we might expect to see more solid evidence in that regard. For example, the committee might want to consider the recent Carbon Trust report on offshore wind, which has a somewhat more detailed analysis of some of those issues.

Lewis Macdonald: Today, the Institution of Mechanical Engineers is launching a report on marine energy, which I understand will highlight the gap that currently exists between the very first stages of research and development support, which has been good in Scotland, and what needs to be done to deliver commercial deployment. Is there a funding gap on the technology side or is the issue—or, at least, part of it—more to do with investment in the grid and permission for the grid to develop?

Professor McDonald: I chair the saltire prize technical advisory board—as you will be aware, the saltire prize will be formally launched in Edinburgh next Monday or Tuesday—and the ETI, the Carbon Trust and the Engineering and Physical Sciences Research Council are part of that board.

The technology challenges are enormous. Some prospective designs are already in the water and are being tested. Scotland has a right to be proud about some of the innovative work that has been done on Pelamis and other emerging designs.

I will not go into the detail of the work that is being done around the saltire prize—the First Minister will do that next week—but I can say that some of the dates by which we can expect serious marine technologies to be developed in the waters of Scotland will be determined by grid infrastructure and the regulatory environment within which people will take a view about the economic sustainability of an investment. Those elements are as important as the mechanical and electrical robustness of the design.

The investment climate is good, which is interesting. There are growing amounts of private venture money looking for opportunities. Without reflecting on the current global situation, I can say that I am aware of four renewable energy funds that have emerged over the past few months—two European, one British and one American—and there might be more. The investment capacity is there, but the technology challenges are enormous.

It is important to recognise that the challenge is as much for Government as it is for the technology developers and the investors. That fact has emerged through the work of the saltire prize technical advisory board. There must be a high degree of cohesion and co-operation between the Scottish Government and its colleagues in Westminster to ensure that the planning and regulatory frameworks are aligned with our policy objectives. They are not necessarily divergent at the moment, but we must ensure that the technology challenges are dealt with by our universities and innovative companies. The investment funds are starting to line up, but one of the big debilitators might be the planning and policy alignment with regard to what we want to do and what we know is going on in other places.

10:00

Maf Smith: The achievability of tidal and wave power is dependent on how quickly we want to have it. These are not new technologies—there have been research projects for many years, and they are moving slowly towards the market. The steady evolution of support from both the Scottish Government and the UK Government has been beneficial. However, much of that—especially UK Government support programmes—has been provided on the assumption that tidal and wave power is an industry for the long term. It might suit the industry to develop over the medium and long term, given the technical challenges that it faces, but the companies that are involved want to develop sooner, because that is when they will get their return; private sector venture capital also wants to get returns on its investment sooner. Scotland needs developments to take place sooner, because we need to develop low-carbon and indigenous sources. That requires greater involvement from Government.

There are gaps in the funding that is available. The saltire prize is a good initiative, as it puts a beacon on the industry. It will be interesting to see what the prize committee rewards and what benchmark it sets. The prize will create one winner and, hopefully, start a race, but support needs to be provided in the interim to help Scottish companies to benefit from it. We must ensure that projects resulting from the prize are developed in Scotland and stay here subsequently. Learning from the wave and tidal energy support scheme, which has been around for a few years, is a big challenge. The scheme has generally been successful—not completely, but it has helped. How can it be replaced and built on? We need a suite of initiatives from the Scottish Government, as well as the UK Government.

As Jim McDonald said, we also need the right planning and regulatory powers. If a developer said tomorrow that it knew how to produce tidal power and could start building devices for the Pentland Firth at a shipyard in Scotland next year, it would be told that it would have to wait for about eight years before it could connect to a significant number of customers through the grid system. Wave developers go to Portugal partly because there are good inducements—we should not mind that too much, because it spreads the cash that will be needed—and partly because the grid system is on the beach, which allows them to plug in and start making money. We do not have that advantage here. As well as finding creative, different ways of managing the grid, we must invest in future infrastructure, because even if we

move at pace, it takes time to put infrastructure in place.

Dr Dixon: I was keen to get to the bottom of the question. Two weeks ago, I was on Strangford Lough in Northern Ireland to look at the tidal device that Marine Current Turbines has installed there. I asked its people the same question: what would enable you to get devices into the water, working perfectly, in big numbers and in a short time? The issue was not capital—throwing a lot of money at it would help, but not a great deal. Technically, the company still has things to prove—some technical work needs to be done before it can build devices on a big scale. However, it raised one interesting issue that the committee may want to consider in more detail. It said that a key limitation for tidal energy is that the Crown Estate is offering only short-term contracts. The committee has heard from the Crown Estate and knows that it is trying to get devices into the water in the Pentland Firth and other places. That is great, but it is offering contracts for only five or 10 years. The economics for a wind farm developer that knows that it will be on a site for 25 years or longer are rather different from spending a lot of money on something that may be hoicked out of the water in only five years.

I offer one more small pointer. Jim McDonald mentioned the positive finance climate for renewables that exists at the moment, which is great. However, it is worth looking at the situation in Scotland. We are a major financial centre, but our financial institutions seem less willing than some others to invest in renewables, even though the renewables are here. At this time of financial crisis, renewables seem like a good place to put money. Is there anything that the Scottish Parliament or the committee could do to encourage the Scottish financial industry to support what is happening in the sector?

Andrew Haslett: I am somewhat constrained in what I can say, as we are in negotiations with marine technology developers. At some point early next year, if we have not been able to fund the projects that we would like to fund, I may be able to respond in one way or the other. We probably plan to spend some more money on marine energy in a year or so, depending on whether we can identify further needs for investment in technology. Please do not forget the huge scale of the technology challenge in making these things work and in making the costs acceptable. That is not necessarily about money; it is also about ingenuity and persistence. Colleagues around the table have referred to things that may act as a discouragement to people, who may feel that their efforts are not going to be taken forward for other reasons.

The Convener: With regard to accessing the grid, does the issue concern the planning process, finance, National Grid or Ofgem? Where is the barrier to the expansion of the grid? Should that be addressed in the national planning framework, which the committee awaits with bated breath?

Colin Imrie: First, I agree that infrastructure is very important. We are talking not just about the electricity grid; we are talking about district heating and planning for electric cars, which we need to start thinking about. The absolute beauty of electric cars is their ability to store electricity overnight in batteries. The advantages are very strong. Clearly, there are technology and acceptance issues; nevertheless, they are an important development.

As far as the electricity grid is concerned, a couple of weeks ago, I talked about the renewable energy framework. I do not want to go into detail, but I will briefly point out the importance to that of bringing forward grid investment. It is encouraging that, following work with the UK Government—Jim McDonald has highlighted the importance of that—the publication of the renewable energy strategy has changed the landscape in the UK about the importance of grid reinforcement. The scenario in there shows 11.4GW of renewable energy from Scotland, which is more than the 8GW that the Scottish renewables framework says should be a base. The UK figure is a scenario. That clearly requires grid upgrades. As we have said, the national planning framework will be highlighted and may need to be upgraded through—as I mentioned—subsea cables into the English market.

The way in which the regulatory system works at the moment is that investment in infrastructure must be clearly justified in terms of current demand, as defined relatively tightly. One of the reasons for the UK Government's introduction, in the Energy Bill, of a sustainability duty for Ofgem is to enable it to take a longer-term perspective on investment. The work that is being done on the need for grid investment clearly identifies the fact that we must look ahead rather than look simply at the short term if we are to plan for 2020. That is one of the aspects of regulatory decision making in which change would be important, and it is encouraging that it is being talked about in that context.

We talked a couple of weeks ago about the regulatory process with regard to planning for grid infrastructure. We are in no doubt—and we stated clearly in the renewable energy framework—that upgrades will be necessary; therefore, it is important that the planning consents system that is operated plays its part in ensuring that those upgrades can be approved.

Maf Smith: I will follow up briefly on Colin Imrie's point about the regulatory processes. We hope that the sustainable development duty will go a long way. However, as someone who, in their previous role, spent a lot of time in meetings and negotiations with Ofgem and working groups discussing how to get renewables on to the grid system, I recognise that the Government will need to monitor the delivery of that duty very closely. The Scottish Government has a role in ensuring that the duty also works for Scotland.

It is understandable that the utility companies do not want to provide assets—they call them standard assets—if there is an unproven need. However, if one looks at key wave and tidal areas, for example, the case that one is making is that an indeterminate group of companies with an indeterminate number of megawatts may wish to connect to the grid at some point on a future timescale of between 10 and 20 years. One can see why Ofgem holds back. How can we get the regulatory system to offer encouragement and take risks? Even when decisions have been made—Beauly to Denny is the most recent example—the planning system still takes a long time to reach a decision. I refer not to consent being given, but to the decision that tells people whether they can start to invest in new energy generation projects.

For those of us in the energy industry, finding out how to do things alongside one another would be useful, but we do not necessarily have that skill. None of us will act on the planning front or think about such issues until we have heard from Ofgem, but Ofgem will not act either and so it goes on—that is why there are so many delays.

Professor McDonald: My shorthand for that is connect and cope. We need to get the right balance, and National Grid and the other operators need to be encouraged along those lines. With connect and cope, deployment would be accelerated alongside planning and investing; the strategy is about engagement, particularly with the utilities. The plan and invest strategy is about engagement with Ofgem and other investors. The two strategies need not be polarised, although that often tends to happen. In taking forward the two strategies, the correct balance needs to be found. People tend to view them as mutually exclusive, but that does not need to be the case. Strategic dialogue with the utilities, National Grid and Ofgem must be taken forward constructively. They are important players.

Dave Thompson (Highlands and Islands) (SNP): On the investment point, the RSE report mentions that

"the gap between capital costs, expected operational costs and revenue still remains too large for substantial industrial commitment",

after which it mentions "the ROC system". According to the RSE,

"The ROCs regime is designed to be technology neutral … However, undifferentiated ROCs will always lead to industry employing the lowest cost option."

Is change needed to the renewables obligation certificate system? If so, what should it be? Would that make a substantial difference to where we are going with all this?

Maf Smith: The obligation system is changing. There has been a single unit of renewable electricity, but that is evolving. I do not have the exact figures to hand, but they are to be found in the draft renewable energy framework.

The Scottish Government is consulting on whether to band the ROC—to have different payments for different types of electricity generation scheme. Banding ROCs would help in setting higher levels for offshore wind and higher still levels for wave and tidal energy. Discussions are on-going on whether the Government has pitched the proposals at the right level. We hope that banding ROCs will create an investment climate in which people invest in those longer-term technologies. We have to get those measures in place, start to deliver them and then leave them alone to let them do their work.

The obligation system is far from perfect, but it has to be seen alongside the need for a stable investment climate. That is the tension: investors need to know that the system will be in place for the long term. Chopping and changing things too much serves only to undermine confidence. Investors need to know that investment money will be around for the 20-year investment timescale within which they want to see a payback from their shorter-term investments.

Professor McDonald: The key element is stability: there needs to be less uncertainty around ROCs. More sophisticated use of ROCs will encourage the development of renewable technologies. We need to be less indiscriminate about what ROCs are intended to do and a bit more focused and strategic about the developments that they might encourage. Obviously, that is the case in terms not only of the banding of ROCs but of the different timescales within which they impact on the technologies that we want to pull through.

Conversations with Ofgem are important. If the British Government and Scottish Government believe in capitalising on the 30GW of offshore renewables, we need to de-risk for investors the infrastructure. I will not labour the point other than to state the need to understand the return on the investment models that are applied to allow National Grid to go about making its investments. We need to see a relatively modest but fairly

secure rate of return for the investors who will invest the many tens of billions of pounds that are needed if we are to create the subsea grid.

We have an important opportunity to be a major node in the European infrastructure that may emerge over the next 25 to 40 years. The key issue is to drive out as much uncertainty as possible. ROCs are one instrument for doing that, but the instrument is too blunt at the moment—we need to sharpen it and make it more sophisticated.

10:15

Dave Thompson: In its submission, the RSE makes a number of comments about the need for guaranteed income over 15 years or so to encourage people to move into the area. If we are to keep using coal, we need to have carbon capture and storage—we should not build any new coal-powered stations where carbon is not captured. It is important to get the technology up and running as quickly as possible. How do you see us doing that? I invite you to comment on the financial incentives, in particular.

Dr Dixon: I agree that carbon capture and storage is extremely important globally, partly because many power stations are being built in India and China. If they use carbon capture and storage, there is some hope for the planet, but if they do not, there may not be. It may be less important in Scotland, as we have more options. As members know, there is a UK competition for a CCS facility, and Longannet is one of the finalists; there are now only three, as one has dropped out. However, let us grasp the reality of that competition. It does not oblige anything to happen until 2014, and it obliges only a fraction of the plant's output to be covered by CCS. Even if Longannet wins and gets perhaps £2 billion from the Government to install the technology, only a sixth of its output will be covered, and not for another six years. We are not rushing headlong towards introducing CCS.

The Government will tell you that this is a proving phrase and that we must prove the technology before we install it on a big scale, but the project is frustratingly small and has a frustratingly long timescale. Scottish Power will tell you that if it got the go-ahead and was given the money tomorrow, it could have the project up and running in 18 months, not six years. Any pressure that the committee can put on the UK Government to make the competition move faster, to implement the technology faster and to do so on a bigger scale than was originally intended would be useful, because in six years' time, when the technology is operating in the UK on a small scale, we will probably find that much bigger, better-developed plants in Europe are proving it on a bigger scale. It is frustrating that the UK is moving so slowly on the issue.

Lewis Macdonald: Is it not possible that, as the Royal Society of Edinburgh suggests, the technology will not deliver and will not be commercially achievable? The society's report makes the interesting point that we need to have a plan B if carbon capture and storage proves not to work in the way in which we all hope it will. Do you agree? How does that square with your suggestion that we leap ahead a bit faster?

Dr Dixon: Clearly we need to prove the technology on a commercial scale, but reasonably sized versions of it are installed in power stations in Europe. Vattenfall is installing one in Germany on quite a large scale—probably larger than we will manage in six years' time, which is disappointing. The technology already works on a small scale; it is used on oil rigs, for example. At issue are the engineering challenges of scaling it up. I do not underestimate those challenges, which are large and need to be overcome, but it appears that, technically, carbon capture and storage is a goer. The question is, will we be able to do it in 10, 20 or 30 years? We need to do it pretty quickly. As Dave Thompson said, if we are to continue to use coal in Scotland, we can do so only under a carbon capture and storage regime that is working well. There cannot be new plant that does not have carbon capture and storage.

Ms Wendy Alexander (Paisley North) (Lab): It would be helpful for the committee to understand the sequencing of technologies. Onshore wind is in place. What more do we need to do on offshore wind, which is a proven technology but could be accelerated much more if the policy and planning climate were better?

Richard Dixon has told us interesting things about how close to market the carbon capture technology is. It would be helpful for us to understand how that could be accelerated. The committee could make a valuable contribution by considering the sequencing within the policy and planning climate. We could unpack—for the ignorant among us, and I certainly include myself in that—the extent to which carbon capture could be accelerated.

Professor McDonald: In plan A for carbon capture, it is the prize that is so attractive. We have three power stations in Scotland that account for more than 30 per cent of our carbon emissions—Longannet about 20 per cent; Cockenzie 10 per cent; and Peterhead 5 per cent. The prize is worth the effort. The upstream technical challenges are enormous and full of risk and uncertainty, but the committee should understand that Scotland has world-class research capabilities.

I warm to Richard Dixon's recommendation of a proper proving phase leading to proper scaling. That will involve a much greater facilitation of engagement with industry. In the west of Scotland we have Doosan Babcock, which has a centre of excellence in carbon capture and carbon technologies; we also have two very open-minded utilities in Scottish and Southern Energy and Scottish Power.

Plan B should not necessarily be about, "What do we do if we don't win the prize in the next year?" Plan B should be about what we can do to develop our technologies in Scotland, and how we can continue to improve the engagement of industry, research work and Government.

We must acknowledge the international challenge. We have an opportunity to consider how best to use hydrocarbons. That is where heat becomes important in the debate—covering issues such as district heating, combined heat and power, and infrastructure for our cities. The subject of infrastructure tends to get us thinking big, because that is where the big challenges are. However, Scotland has another opportunity to make a difference by thinking about a sustainable cities agenda. As we develop our major conurbations for our citizens, our industries and our commercial users, we should think about sustainability and ensuring that heat generated efficiently in more localised power stations is put to greater effect. In Denmark, policies and investment frameworks require all new power stations to use their heat effectively within public district heating agencies.

The technology of carbon capture is important, but we will also have to use hydrocarbons more efficiently and to develop renewables. We have to widen the discussion and make much better use of the heat that is generated in the production of electricity. Carbon capture and storage is a big prize for us, but let us not take our eyes off the ball if we do not win the latest competition. The issue is about not just big power stations, but how we use the heat as well as the electricity.

Dave Thompson: The RSE's submission mentions the possibility of investigating devolved or EU incentives within or outside the UK competition. It goes on to give three or four options. Perhaps we should be considering not just the competition but other options, too—for example, to accelerate the processes using other funding mechanisms, from Europe for example, and give the scheme to Longannet. Would it be feasible to do that?

Maf Smith: Among the tools of the Scottish Government is the tool of planning. For at least the past four years, the Scottish Government has used planning as a tool in nuclear policy, even though nuclear policy is reserved. The same could apply to planning policies for new coal plants. The Scottish Government is consulting on section 36 of the Electricity Act 1989, on thermal performance standards. That consultation and the decisions that the Government will take will be important.

For example, the Government could choose to demand that all plant is capture ready, but it needs to ask what that might actually mean and by what timescales carbon capture within plants could be delivered, and whether there might be ways to tighten things up by imposing thermal performance efficiency standards and carbon standards on new plant. The Government could take quite a strong line, and impose strong minimum standards. That could be backed up through investment and incentives. It is important that the new plants do not make the situation worse by adding new carbon.

It might be useful to consider not only the carbon capture plant that would be put in alongside a generation station, but the necessary infrastructure. If carbon capture evolves, there will be a large market for carbon storage and transfer. Most of that market will come from Holland and Germany, which will be looking for routes into the North Sea as well as land routes. Carbon from those areas will come into the Lowestoft area, where there is a gas infrastructure, and then go up the coast; it will stop where it finds that the market is helpful. There are opportunities for Scotland to use its expertise in oil and gas to start exploring carbon capture and storage and to put in place that wider infrastructure, which would, in itself, incentivise installing the plant at the individual sites. People will not build a plant at a site if there is nowhere to store the carbon, whereas, if the infrastructure is already in place, the task becomes a little easier.

Andrew Haslett: I strongly support what others have said. We could build a carbon capture plant tomorrow. It is not something that we do not know how to do, and there are a number of technologies that could be made to work. Depending on which technology were to be chosen, you might end up either with something that is more economic in the long term but riskier in the short term, or something that is more likely to work in the short term but, possibly, less economic in the long term.

The first plant will be risky, because it will be larger than anything that has been built before and will be integrated in a different way. However, the only way of developing the technology is to build it. There is an issue to do with the fact that, even though the technology that is associated with marine power is much less well developed, a wave power turbine can be built for a much smaller sum of money than a realistically scaled carbon capture plant can be built for. However, there is enough proven storage capacity in the depleted oil and

gas fields in the UK to replace around 70 per cent of the current coal plants with carbon capture coal plants, so security of storage will not be a problem. Further, the technology for putting in the CO_2 mains is not exotic and has been practised in some parts of the world.

The fundamental question is how we can create an environment in which all that can happen, if that is what we decide that we want to happen—clearly, that is a democratic decision that must be made.

The current price of CO_2 is not sufficient to encourage anyone to invest in carbon capture and storage. It is not even sufficient to persuade anyone to invest in carbon capture if they were planning to build a coal-fired power station anyway. A bit more than £40 a tonne will be needed to drive that investment, and, even at that price, it is still more economically attractive to invest in a combined cycle gas turbine plant and pay a penalty for the CO_2 that would be emitted.

Some strategic decisions have to be made about what we are trying to achieve and what incentives will be offered to investors to encourage them to provide the large capital sums that Jim McDonald was talking about.

Dr Dixon: We have to be careful about what we mean by the phrase "capture ready", which Maf Smith mentioned. If we are not, we might end up with a power station that has a pipe with a valve at the end of it that leads into a green field. Although such a power station might be said to be capture ready, as someone could build a plant beside it at some point, it would not mean that anyone would be doing anything about the emissions until that point.

On the competition, there are currently three finalists. One is Longannet, which is an existing power station. If it won, a sixth of its emissions of CO_2 would be captured, and no additional CO_2 would be produced. The other two finalists are power stations that do not currently exist, one of which would be at Hunterston. If one of them were chosen, we would be capturing a quarter or a sixth of its emissions and allowing the rest—which would be new emissions—to go straight up into the sky, which would be a disaster. If someone is going to win, I would be in favour of it being Longannet.

10:30

Under section 36 of the Electricity Act 1989, Scottish ministers have powers to set thermal standards, which are similar to the powers that have been used in California. If the Scottish Government were to set such a standard, a power station could not be built unless it met that standard, which would rule out various technologies. Longannet currently emits about 800g of CO_2 for every kilowatt hour of electricity that it produces. If you were to set a standard that meant that nothing new could be built that produced more than 350g of CO_2, you could not build a new coal-fired power station unless it had carbon capture and storage working from the start. You could build a very efficient gas plant, so you would be driving the use of fossil fuels in the direction of gas, which is a good thing. When you got to the stage at which you thought that every power station should have carbon capture and storage—even an efficient gas plant—you could reduce the standard to drive that efficiency. The Scottish Government has the power to tell operators who want to build a power station in Scotland what sort it is going to be.

Colin Imrie: Generally, because of the way in which the electricity market works, the possible incentives for carbon capture and storage come from market mechanisms and emissions regulation. It is possible to envisage in the longer-term future some system that would incentivise carbon capture through market mechanisms. However, at this stage, that does not exist, which is why the UK Government has launched its competition. As Richard Dixon said, there are two candidates in Scotland—one is an existing power station and one is a proposal that was launched last week.

The thermal guidance poses questions about carbon capture readiness and what that means in practice, but it also asks for suggestions on how it can be ensured that it works. So, this is an important opportunity in terms of the Scottish Government setting its conditions.

One of the challenges that we face is that the European Union directive on carbon capture and storage, which includes readiness, is not yet agreed. Exactly what will be required by EU legislation will not be clear until probably next month, when the climate and energy package is agreed. There is resistance in certain parts of Europe to the idea of having any requirement in this area. However, that does not prevent the UK Government or the Scottish Government from adopting higher standards, as long as that is accepted. The consultation is an important process and stresses the importance of having clear declarations from the developer of what they will do in relation to heat; that point has been raised by others.

The European Union is considering alternative funding models for demonstrators. Demonstrators are being funded because, at this stage, the CCS technology is not regarded as ready, although the Vattenfall project and other initiatives are important. That is a possible extra source of funding, although I am sure that, under EU terms,

it will be only a proportion of the funding that is required to make a project work.

I am not an expert on transport, but from working with the energy technology partnership I know that there are experts in Scotland who know that the storage sites in the northern North Sea between Scotland and Norway are probably the most suitable because of their geology. Stuart Haszeldine of the University of Edinburgh is talking to the European Commission today about opportunities to develop projects under the auspices of the new Scottish European green energy centre, with a view to Scotland playing a role in transport networks for the future.

Andrew Haslett: I have two slightly different comments to make, one of which relates to CO_2 storage. However, first, I will pick up on the comments that have been made about heat.

I do not see how you can determine a strategy for electricity generation until you have determined your strategy for heat. Heat is the largest consumer of energy, and you must first decide how low you can make your heat demand by implementing efficiency measures. That determines the demand and is probably the most difficult piece to deliver in terms of the organisation, the technologies, the skills, the supply chain and the incentives that are required to make it happen. Broadly speaking, you could supply heat in a number of different ways. You could supply it from electricity, in which case you would probably have to more than double your electricity generation or demand. That poses challenges of a completely different order to replacing existing electricity supply with lower CO_2 means.

Alternatively, you could supply your heat by combined heat and power. It is hard to see how you can deliver heat efficiently without making electricity at the same time. That gives you several options for where you locate the generation and how you transmit the heat from the place where you are generating the electricity to where the heat is required, which is in houses and buildings all over the place. You might well have a mixed economy, which means that it is more effective in some locations to supply the heat from renewables, such as wood, but in other places it is more effective to supply the heat from large industrial or power generation facilities.

A third exotic option would be to supply heat to houses by using low-carbon fuel, probably hydrogen. Not many people have been able to see how we might get from where we are today to having a hydrogen-based economy in the UK. However, I am not sure that anyone has studied the matter in sufficient detail at a systems level in order to understand what issues would have to be overcome and what advantages such an economy would have. Heat needs to be understood first.

As for CO_2 storage, I mentioned that we are about to commission a study, which will include Professor Haszeldine, of course, to look at the next level of granularity and understanding of CO_2 storage capacity in the UK. It will concentrate mainly on saline aquifers, because we believe that the gas and depleted oil field storage is reasonably well understood by the operators of those fields.

Rob Gibson (Highlands and Islands) (SNP): I return to the electricity grid for a minute or two to ask about two aspects: the cost of the technology; and the management of the grid. We understand that the onshore and offshore parts are complementary, so has the cost of direct current cabling come down sufficiently for us to understand it in relation to what we know about the onshore cost? On managing the grid, as I represent the Highlands and Islands, I am aware of the wide variety of different sources, including the potential to feed CHP into the grid. How will we manage the distribution and supply of those elements?

Professor McDonald: You asked two important questions. High-voltage DC transmission is well understood, so the technology for creating DC grids has been understood for many decades. However, technical reality is one thing; affordability and economics are another. Changing technology is allowing us to think about new power network architectures and operations called power electronics. I will not go into a lot of detail other than to say that the technology allows us to be flexible in how we go about taking outputs from renewable sources, some of which might be better taken as DC and alternating current. The history of the development of electricity architecture over the past century shows that 50hz is an accident of machine design that formed ultimate standards and, thereafter, industry and regulatory policy. We do not need to stay with 50hz and 60hz over the next 20 years, particularly in distributed power networks, where there is a chance to be innovative, especially in the case of isolated power systems on the islands, for example. If we are to have more autonomous cities, DC distribution and transmission might be a better option.

The costs will always be an issue, but they are moving in the right direction. The flexibility of grid design and architecture is now driven by the fact that we have large 50hz grid infrastructure that is 50 to 60 years old and which, by and large, is not found where the renewable sources are found. As a consequence, for the first time in half a century we have a chance to design a power system that is future proof. If we simply replaced transmission

systems like for like, we would make a bad decision.

The recent EU report on supergrid technology conservatively estimates a required investment of approximately €500 billion between now and 2030 to replace the grid. That is one datum. What is more important to me is the fact that we must not only reinforce the existing grid, but apply much of that public and private investment to networks that are much better suited to the sorts of technologies, uses and mega-city architectures that are developing.

On the management of the distribution network, interesting technologies are being deployed in Scotland. In Shetland and Orkney, we have the first deployment in Europe of active network management technology. SSE has taken some incentivisation projects from Ofgem and created a small spin-out company, in partnership with the energy technology partnership, which includes the University of Strathclyde. That company manages the network much more intelligently, with greater automation and less dependency on old architectures. We all recognise the architecture model that involves large centralised stations and a large integrated grid, but that is not necessarily the model for the future. The way in which we go about managing large-scale and small-scale grids can change quickly through the use of information and communications technology. Scotland has the opportunity to be a world leader in that area.

Rob Gibson: What should the committee recommend? Should particular elements develop sequentially, and should our Government and the UK Government be enhancing them?

Professor McDonald: Next month, I will be with Ofgem to launch its future scenarios. Scotland's scenarios cannot be independent of those of the UK and Europe.

The Department for Business, Enterprise and Regulatory Reform centre for distributed generation has recently published two papers for the UK Government that look at five scenarios through to 2020 and 2050. We need to look at those so that the Scottish Government can take a view on how its own requirements are embedded in them.

Ofgem has now published its view on five future scenarios up to 2025. Why has it done that? I am looking at the economics experts around the table. Ofgem has asked, "What is a desirable future for the UK?" It has then back-cast the policy investment and technology development requirements that will be needed to realise those potential futures. I will leave some information for the committee about the long-term electricity network scenarios—LENS—that Ofgem has commissioned and the EPSRC supergen scenarios that have just been published by the University of Cambridge, the University of Strathclyde, BERR and Ofgem.

I am not avoiding Rob Gibson's questions. The key thing is to ensure that our scenarios are well informed by the serious analysis that has been done until now. The last thing we need is a set of new scenarios that do not take cognisance of the good work that is already on the table in Europe and the UK. Once you understand your future in those scenarios, you can have proper dialogue, influence the people that you can influence and bring about change in the places where you do not have good influence.

Rob Gibson: Despite the renewable energy strategy that Colin Imrie talked about, is there a tension between the priorities of the British Government and those of the Scottish Government because of the potential development of nuclear power stations close to centres of population in the south? Does that mean that discussing the grid as we are doing becomes less of a priority?

Maf Smith: There are clear tensions because we are part of the Great Britain market. We have seen that with charges and the way in which the regulatory system encourages different types of generation.

I suspect that the UK Energy Bill and the moves afoot to change the way in which Ofgem operates will lessen those tensions by making Ofgem take more account of carbon and wider sustainability issues. However, Scotland has different challenges because its grid system is much more dispersed than the English or Welsh elements of the GB grid. That might mean different priorities, and it might be a challenge to get different benefits out of the regulatory system.

Jim McDonald's Orkney example is a good one. The GB system has effectively incentivised an experiment. It is not about using new technology as much as it is about applying it on a different scale. The more we can learn from that, the more we can encourage Ofgem to have more such initiatives, rather than create an isolated example that everyone praises but which is never rolled out. That would produce benefits in other parts of Scotland, particularly the Highlands and Islands.

10:45

Rob Gibson: Given our diverse sources, we should stress such points.

Professor McDonald: I support what Maf Smith said. We have not talked much about how the Government's targets articulate with the lifetime or otherwise of nuclear stations, but we must factor them in when we roll forward 20, 30 and 50 years.

Scenarios that are available to members show that when we roll forward to the retirement of both nuclear stations in Scotland and take into account potential outcomes in our renewables, coal and gas mix, we have very high carbon emissions from the electricity side of the energy sector. We need to think hard about that. If the retirement of nuclear stations rolls out—that is another debate—that will have big implications not only for renewables, but for coal and gas. We must not forget that. The energy mix at large is important.

Tensions will arise because, in the UK, a new generation of nuclear is likely in the next 20 years. How we position ourselves alongside that development is important. The lives of the nuclear stations in Scotland could be extended. Dialogue with EDF and British Energy will be important. The Government's consultation target of an 80 per cent reduction in emissions must be understood alongside what is happening in nuclear. We cannot ignore that. The Government has a position on it but nonetheless this is about not just renewables, but infrastructure, heat, transport and other forms of generation. That is why I strongly recommend that the committee is well informed by other scenarios that are developing throughout the UK and Europe, of which nuclear is a clear part.

Andrew Haslett: Control and design technologies are important. Jim McDonald talked about what we might like to call wires and boxes, but the environment will be much more complex. Among the scenarios in the LENS report, those that lean towards achieving our CO_2 reduction ambitions have a much higher level of control built in. We are in a world with new storage technologies, such as sodium-sulphur batteries and some of the power electronics technologies that Jim McDonald has designed, for which our historical systems were never designed. The tools for designing and optimising those complex systems for new technologies are not available. The issue might not be exciting, but, given existing uncertainty, we need the engineering tools to design and optimise the systems and, particularly, the metering technologies.

For example, electrifying transport would place huge electricity demands under consumer control. It does not take a high penetration of electric vehicles in an area before the life of substations is reduced dramatically. The natural pattern of usage of an electric vehicle is that, after leaving an office with the lights on, someone drives home in the vehicle to a home that is cold, where they put on the lights, the television and the cooker and plug in their car. For the asset base and the efficiency of the electricity system, that is exactly the wrong moment at which to plug in a car. A means is required to signal to the consumer that they should plug in their car and operate their dishwasher and their washing machine at 10 o'clock at night and not at 6.30 in the evening. That can be done only if some intelligence is embedded in the retail electricity system, out there in the distribution system. That is completely different from what exists at the moment.

Such technologies are being developed all over the world, but I am not sure whether anyone has implemented them fully anywhere. Standardising and requiring the implementation of those technologies is a fundamental building block in any strategy for efficiency and determining investment. Without proper control, investment in assets will be much more than is required and assets will be used much less efficiently. Such technology is key.

Dr Dixon: Intelligent washing machines are interesting but, as members might expect, I will return to nuclear power. We in Scotland have plenty of time to deal with the phase-out of nuclear power. With its five-year extension, Hunterston is not due to shut until 2016. Its life might be extended by another five years.

The Crown Estate told you that it wanted to get 1GW from tidal and marine power by 2020. That is as much power as is produced by a nuclear station, and it is produced in a very predictable fashion—we are able to say what the tide will be doing in 30 years' time at 3 o'clock on a certain Tuesday afternoon, for instance. That is predictable energy that provides the base-load.

By 2020, the Crown Estate expects that we will have easily replaced enough generation capacity to turn off Hunterston. After all, it really only generates electricity to export to England; we do not need it in Scotland. Torness will go on until 2028, with its current five-year extension, and probably longer than that. Two nuclear stations will therefore be with us for quite some time.

The Crown Estate also told you that it would like to generate 10GW from water by 2030 to 2040. That would mean that twice as much electricity as Scotland needs at its peak would be generated just by tidal machines. That is our opportunity. Scotland is perhaps in a better place than most countries to phase out nuclear power over a sufficiently long time that we are able to replace it all with renewables.

Christopher Harvie (Mid Scotland and Fife) (SNP): Where did we go terribly wrong? Back in the 1960s, we closed down power stations such as those at Portobello and Pinkston, which were near city centres. We then shoved power stations, whether they were nuclear or thermal, out to the wastes, thus depriving us of dual CHP use.

The Germans are contemplating with relative equanimity whether to continue with or drop nuclear. Germany is the biggest industrial power in Europe, and industrial energy usage produces a

much greater level of carbon emissions than energy usage by services.

I would like to hear the panel's opinions on the importance of the Stadtwerk structure in Germany, in which the local power supply, sewerage and transportation company is run by the town council and is also involved in education and civic consciousness. Stadtwerk has enabled my own town in Germany, Tübingen, to install a 90 per cent efficient university power station, which is also the heating centre. The same goes for the transformation of the bus services and everything like that.

Britain's structure of control is not conducive to good municipal housekeeping, and Scotland requires the sort of approach that I have described. We have colossal local authorities that seem to have very little locus in communities that demand both power and the conservation of power.

Supermarkets have been expanding enormously, but when they tell us how much power they can save—for example, 40 or 50 per cent of their present usage—we begin to get suspicious. By not having street markets, small shops and small supermarkets, how much does retail contribute to what is an exaggerated demand? Supermarket buildings are simultaneously warmed and cooled. People come to supermarkets by car, and goods travel enormous distances by lorry to reach them. Does that not suggest that we should examine the end use of the products of power?

The use of power in other ways has been mentioned. Of the heat that is generated at Longannet, Cockenzie and Peterhead, 64 per cent shoots up their funnels into the atmosphere. We were told that only 36 per cent of what is generated at Longannet actually goes to transmitted power. The problem of giantism seems peculiarly Scottish, and it is difficult to overcome given the absence of organisations such as local power and utility companies.

The Convener: As they say in the best exam questions, "Discuss."

Christopher Harvie: But you should not write on both sides of the paper.

Maf Smith: Christopher Harvie raises a lot of good points. There are some very good examples of energy use from around the world—particularly Scandinavia and Germany—that we should follow. We have spoken about new technologies, but a lot of the scenarios that we are discussing are about old-style approaches to organising technology.

It is important to consider how local authorities plan for the future through local planning partnerships. We have spoken about thermal performance standards for new plants, which could deliver benefits. On behalf of the Scottish Government, Richard Lochhead made an announcement to the Parliament earlier this year about zero waste, with new thermal performance standards for energy-from-waste plants. If those standards go through into the planning process, they will change the way in which companies deliver energy-from-waste plants. Without actually saying so, that approach will mandate them to carry out CHP or heat schemes, rather than just electricity generation, which is likely to change the scale of waste plants. The emphasis will not be so much on large-scale incineration, but on schemes such as the one that has been operating in the Western Isles, where there is a smaller-scale heat-type plant.

Government can set minimum thresholds, and the industry can decide how best to deliver. It could do so partly by gigantism, but there could also be more local solutions. Giving planning authorities the power to intervene will help.

We spoke earlier about investment. How can we encourage investment and channel it into sustainable infrastructure and the energy generation that we have talked about, as well as transform public services and green spaces? In the current climate, there is an appetite for longer-term investment models to deliver such outcomes. In Scotland, people have an opportunity to speak to people in the financial houses, investment companies and pension companies about the sort of things that they would welcome, and to ask how the Government could set minimum standards to encourage the things that they would invest in. We do not just have to react to the market; we can encourage and direct it in certain ways.

Professor McDonald: For the committee's information—members might wish to reflect on this in more detail another time—a very interesting project is being run in Glasgow, commissioned by Glasgow City Council. The Glasgow sustainable city project—it does what it says on the can—receives significant investment from external partners, and Glasgow City has itself put in a significant amount of funding. The project has been three months in the running, with another six months to go. Detailed analysis from the project will be reported, with plans and white papers, effectively, for what Glasgow—certainly the east end—could look like.

The 2014 Commonwealth games provide a catalyst. There will be significant change to the shape of that part of Glasgow. We understand the socioeconomic difficulties there but, on the upside, several work streams are under way. I will be delighted to inform the committee in due course about the district heating infrastructure that can be embedded; about the CHP plant to be built in that

area of the city; about low-carbon—we cannot say zero carbon—public transport, which can be achieved in several ways; about integrated renewable energy sources in the centre of the city, not only in buildings but on sites, that use the Clyde; about the built environment that might emerge, with efficient homes that are designed for low-demand use; and about control and communications infrastructure, which Andrew Haslett touched on. If we are going to have smart cities, we need access to real-time data, so that the management of the city structure can be brought about and energy services can be delivered using the web. The comms and control infrastructure has to be in place.

It is important to gauge public attitudes towards the changes. We need to realise that our citizens must engage with the opportunities. The projects are being done not to them, but with them.

Last but not least, we must consider policy—on the large, small and local scales. How might the projects be paid for? Without going into detail, the major partners are Veolia, which is a €40 billion-turnover company that operates predominantly in Europe and North America, and Scottish and Southern Energy. There are indications that, if the sustainable city project comes out on the upside, those project partners might well capitalise it directly, alongside the service contracts that could take them through a commercial return.

There are innovative ways to do such things, which takes vision. As Chris Harvie indicated, such an approach could largely depend on action at the city level, as well as on a large infrastructure level. Members should be aware of the project that I mentioned, and I am happy to tell the committee more about it in due course.

11:00

Dr Dixon: Quite a few years ago, I was in a school in Estonia in the middle of winter with all the windows open. There was a power station up the road and, of course, a district heating scheme that heated the school. The radiators had no controls—they were just on full and very hot, so the windows had to be opened. They did not quite get it right, but the heat was being used, whereas in our country, we dump the heat and warm up the Firth of Forth or send it up the chimney. I have talked to Scottish Power about what it does with heat. For instance, I asked what will happen with the heat from the proposed new biomass power station at Longannet and was told, "We've talked to people round about, but we can't find anyone to take the heat." The station will burn biomass and, because it is a nice modern plant, 50 per cent of the energy will go into electricity, but 50 per cent will be completely wasted as heat.

That should be a crime. In this century, with our concerns about climate change, it should simply not be possible to do that. However, it is down to Scottish Power's good will to go and find a partner—for example, to build greenhouses to grow tomatoes with the free heat. As Scottish Power is not in the business of growing tomatoes, it relies on someone else out there in the market. Because we do not value heat in the way that we should, people do not think that it is a good idea to build a tomato plant right next to a power station. We need a change of thinking on that.

Christopher Harvie is right that Germany has a good approach on town centres. There is huge potential for us to make more energy from buildings. When the Parliament building was built, there was talk about whether it should have a gas-fired combined heat and power plant that would not only heat the building, but produce all the electricity that was required, or a great proportion of it. That did not come about, because the economics did not stack up at the time; given the rise in gas prices, that probably looks like a mistake now. If we cannot get that right here in our symbolic great building for the nation, we need to try much harder outside it to make up for that.

We carried out a study with Greenpeace to identify where the heat users are in Edinburgh. For instance, the hospital uses lots of heat, and there are many housing estates. We mapped the heat use and matched it up to where we might have district heating schemes or CHP schemes using gas or wood. We concluded that there is a lot of potential if we can get somebody—for instance, the City of Edinburgh Council—to lead. That approach could deliver a 30 per cent reduction in CO_2 emissions from the city by 2025, if we really went for it. It would also be cost effective. There is lots of potential, but Christopher Harvie is right that the key is that somebody needs to lead.

In the financial district, you can take a tour of Standard Life's building and be told about all the lovely energy efficiency aspects of the building. Next door, in the Edinburgh International Conference Centre, you can be told about all the lovely energy efficiency aspects of that building. However, there could have been one gas-fired plant producing electricity and heat for all the buildings in the financial district, but because there are separate companies that cannot talk to one another and which do things at different stages, they could not make that happen. Therefore, there is a key role for Government, and for local government at the master planning stage. The local authority should plan how such districts are to be built. The same applies to developments such as that at the waterfront at Granton. That is the stage at which we must force a move towards district heating and combined heat and power systems.

Colin Imrie: We discovered—I think that it was in relation to a case in Glasgow—that a provision in the Electricity Act 1989, which is Westminster legislation, prevents local authorities from generating electricity. That relates to the way in which the market operates. The provision does not encourage the type of initiative that has been talked about. However, the issue is being considered. It seems to me that a more sustainable approach to decentralised energy management involves a clear role for local authorities, alongside private companies. As Ofgem's role changes and its sustainability remit comes in, a recognition of the public-private partnership opportunities may be factored into the way in which the market works.

Lewis Macdonald: Before we conclude, it would be useful to ask the panel about energy security. We have heard a bit about scenarios and whether, for example, we will need base-load supply to provide security in the event of intermittent power sources not delivering. We have also heard from people who have been surprisingly relaxed about increasing consumption of gas, which I would be nervous about endorsing, given the international circumstances. I would be interested to hear witnesses' views on both those issues. Is it true, as WWF's submission suggests, that even though global energy demand is expected to double by 2050, we in this country do not need to worry too much about base-load supply? Secondly, should we be relaxed about increasing dependence on gas, given the international situation? If we should not be relaxed about that, what primary steps should we take?

Dr Dixon: It is legitimate to wonder where our gas might come from in the future. There is occasionally tosh talked about how we already get gas from terribly dangerous states such as Norway and the Netherlands. We do not need to worry just yet. In the future, of course, we might be more reliant on gas from Russia, for example, which has—as we have seen—cut off the Ukraine's energy supply. That is a legitimate concern.

At the moment, we view gas as a bridging fuel. If we need more base-load electricity—even if Cockenzie power station shuts down and Longannet comes to the end of its life, we will still have Peterhead, which is capable of producing half of Scotland's electricity, if it could just get the electricity out of the area—we might be relaxed about opening another new gas station to tide us over until the renewables are fully up to speed.

As regards base-load supply, I mentioned tidal devices, which probably make lots of electricity for 80 per cent of the time they are in the water. For the other 20 per cent of the time, when the tides turn, the water is not moving fast enough. Production for 80 per cent of the time is, however, probably better than the average figure for nuclear stations over the past few years, and is quite good for base-load supply.

On renewables in general, we in Scotland have the best resources of anyone in Europe, so if we want security of supply, we should play to our natural strength, which is renewables. If any country in Europe is to have 100 per cent of its electricity supply and, eventually, 100 per cent of its energy needs met by renewables, it should be Scotland. If that were the case, we would have an extremely secure wholly indigenous energy supply. In addition, we would reap the jobs benefits of exploiting that technology and selling it to the rest of the world, so renewables are obviously the way to go. If we were in Luxembourg, we might think differently, but renewables must be the way to go in Scotland. That will happen—because renewables are a mix of technologies, they will meet our base-load demands and give us security of supply. Eventually, we will not need to import any sort of fuel from anywhere.

Maf Smith: I take issue slightly with Richard Dixon's figure of 80 per cent for tidal energy. All energy sources have different profiles: the profile of tidal energy is foreseeable, but it is still variable. The studies that we did on tidal barrages—which apply particularly in England—and tidal streams show that it is not a catch-all technology. Strength lies in being able to overlay different technologies. A study that the University of Edinburgh did for the Scottish Government three years ago examined what happened in various scenarios involving wind, tidal and wave energy and found that significant predictability is possible. However, as has been said, when it comes to managing demand, it is necessary to have layers.

We will continue to need gas, but increased efficiency will allow us to be less susceptible to reliance on it. If we were to use CHP, the result would be that the need to use gas in homes would be lower—we would be less reliant on gas. It is partly about where the fuel comes from, but it is also about how the market works, so even if we had not needed to import gas, we would still have been hit by the price rises because of international market trading.

The same goes for our oil supplies. Even with strong supply, we will still be hit by market changes and the impact of peak oil, for example. We will not be immune to such factors, but if we achieve greater efficiency per unit of use, such impacts will be less of a shock. As Richard Dixon said, we must think about the transition to future fuel sources, of which we know we have a good supply. The strongest elements of those are the renewables, both because they are renewable and

because we have significant resources of them in Scotland.

Colin Imrie: Lewis Macdonald's point is important. It is estimated that the UK will produce only about 20 per cent of the gas that it consumes by 2020. I think the current figure is about 90 per cent. We are therefore moving downwards. Gas is certainly a very important fuel in electricity generation, but it is also particularly important for domestic heating. The UK Secretary of State for Energy and Climate Change has the power to decide whether, on security of supply grounds, an electricity generation plant in the UK that is fuelled by hydrocarbons or gas should go ahead. For our forward planning, we assume that coal will continue to play a role, which is the reason for the consultation on the importance of ensuring that carbon capture and storage can work effectively alongside gas.

In respect of the guidance on thermal power stations, the potential of renewables is regarded as being important in the longer term if renewables can power a whole system, but there is also recognition that cleaner thermal generation will have a role to play in Scotland's future energy mix, particularly in production of base-load capacity.

Andrew Haslett: I think that, in fact, 20 per cent of the UK's gas consumption is imported. However, Colin Imrie is only one year out—we produced all our own gas requirements in 2003-04. The situation is changing rapidly. It is probably also worth noting that we currently have 15 days of gas storage in the UK, including the line pack in the transmission system. Most countries that are as dependent on gas as we are, but which do not have the benefit of indigenous gas supplies, would think that 45 days of gas storage would be better. The technology for storing coal is, of course, a good deal simpler and involves earth-moving equipment. The technology for storing gas is a little more expensive and complex.

Gas power stations are efficient, much cheaper than any other form of power station and have lower CO_2 emissions. From the point of view of an investor in a gas power station, the simplest and easiest thing to do is invest in another gas power station. Unless the economics are biased in another way, we will get gas power stations. The security of supply issue is more to do with politics and global economics than it is to do with technology. However, there must be risk if we allow our country's base-load generation to be too dependent on gas.

The intermittency of renewables is a hot topic among the people who have detailed data. Many people make broad statements about the issue. However, the question is a detailed one. It matters to people if electricity is not available for even a small amount of time. If it happens to be three days in January, that is significant. The unavailability may be an unlikely event, but if it is possible, people have to think about preparing for it. I am not sure that we have sufficient understanding yet of what the system would look like in order to be confident that we know exactly what we are doing.

Rob Gibson: I wonder whether we should extend the definition of energy security into the cost of the fuel source, given the free nature of wind, waves and so on, and the limited nature of hydrocarbons and uranium. I wonder whether that aspect ought to be part of the debate on energy security as a whole.

The Convener: I think that that was just a comment. Dave Thompson has another point.

Dave Thompson: We found during our tourism inquiry that there is a lack of reliable statistics. I know that Jim McDonald has been doing work on that. The RSE suggested that the committee look seriously at recommending

"the creation of an independent, authoritative audit body responsible for collecting and publishing reliable energy statistics."

The basis for that, which I think is sound, is that the debate should not be about the statistics, because we should have reliable statistics, but about what we need to do. Perhaps Jim McDonald would want to comment on that.

11:15

Professor McDonald: I had hoped to make a comment before we close.

First, I agree with David Thompson. It is most important that the committee and Government have access to independent thinking. In sessions such as this the committee hears opinions; fortunately, they are well-informed opinions, which is not always the case in the energy debate. Today's discussion has been particularly well informed.

You will not be surprised that I support the RSE's recommendation. The committee will take a view on how that might be taken forward through Government, but the partnership between the RSE and the energy technology partnership should be seen as a set of independent and well-informed groups that have good resources to provide the committee with data, information, modelling and analytical support, which will help you as you go forward. The intention is not to drown the committee in technical papers, but to provide you with data and information in summary format, which will enable you to make well-informed decisions.

On the proposal to set up a commission, I am sure that I can speak informally for the RSE and

formally for the ETP when I say that we would enthusiastically engage with such a commission. There are ways of committing resources to supporting the committee.

The Convener: That exhausts the questions and the discussion, which has been interesting and will help to inform the committee's future work. A number of valuable suggestions have come out of it. I thank Colin Imrie, Jim McDonald, Andrew Haslett, Richard Dixon and Maf Smith.

I will mention a couple of energy-related events that may be of interest to members. Lewis Macdonald mentioned the marine energy report by the Institution of Mechanical Engineers, which is published today. There is a briefing on it in committee room 1 at 2 o'clock this afternoon.

Also, this evening the Sustainable Development Commission is launching its report at Our Dynamic Earth. I have heard that there will be at least a couple of good speakers there. I think that Richard Lochhead is also coming along. It should be a good occasion, so members may be interested in that.

Next week, the committee will visit the Scottish Power grid control centre at Kirkintilloch. We will get a bit more information about how the grid is managed and will be able to ask some of the questions about grid management that are becoming central to the debate.

I suspend the meeting while the panel departs.

11:17

Meeting suspended.

11:23

On resuming—

Visit (Dundee)

The Convener: The next item is a note of a meeting that I attended on behalf of the committee—I went to Dundee to visit the computer games industry. The director of the games up? campaign invited me to visit Dundee, which is a key location for the industry. We visited Realtime Worlds—it is one of the major companies in gaming and employs more than 200 people in Dundee. I also met senior staff from the University of Abertay Dundee, which is a leading establishment in the games industry.

A key point that I want to stress is that computer games sometimes get a bad press and people do not understand the sector: they think that people who make games are just playing. In fact, it is a very interesting area. The maths and physics behind computer games are immense. We saw some interesting work being done at the University of Abertay and Realtime Worlds. Some of that stuff can have applications outwith the games industry in medicine or other fields. It is at the cutting edge of computer technology.

Scotland has a lead in the technology in this important industry, which is worth billions of pounds. The potential for Scotland to earn money is immense. We heard, for example, about the launch of the World of Warcraft game—some of you might have heard about the queues at stores when it was launched—which grossed $500 million in its first week. Grand Theft Auto—a game that gets a lot of bad press—which was developed in Dundee and is now run by a company in Edinburgh, grossed more in its first week than the movie "Quantum of Solace". The games industry is a very big part of the media industry.

Other committee members might wish to pay a visit to Dundee to see the industry and to speak to people at the University of Abertay and Realtime Worlds, both of which would be happy to host any such visit.

The Department for Culture, Media and Sport, through its creative Britain strategy—that might be a slight misnomer, given that the department does not deal with culture in Scotland—is looking to set up a centre of excellence in computer gaming. There is a very strong case for that centre to be based in Dundee, given that the work that is being done there is already at the cutting edge of the technology and the educational aspects of the industry. We can indicate our support for the idea that the UK centre of excellence for computer gaming be based here in Scotland at the University of Abertay Dundee.

Lewis Macdonald: In that case, you would not suggest that the DCMS change the name of its strategy to the creative England strategy, because that suggestion would be rather self-defeating.

The Convener: We are talking about a creative Britain technology. The competition for the centre of excellence is UK-wide, so we must ensure that decisions are not based only on England.

Lewis Macdonald: I am sure that you got some practical, hands-on opportunities to sample the wares of the industry, which is certainly worth doing. I have to confess that I would not have thought that re-enacting scenarios of war was your forte, convener.

Rob Gibson: As well as being famous for jam, jute and journalism, Dundee can add gaming to its important contribution to the future economy. We should recommend that the opportunity of the UK centre of excellence be taken up, given its important international status. We can only live with the current scenarios of creative this and creative that.

Lewis Macdonald: I might have overlooked this, but will a written report be circulated to members?

The Convener: The report is with the papers for the meeting.

Lewis Macdonald: I apologise; I had not spotted it.

The Convener: I should have added that one of the issues that came out of the meeting with Realtime Worlds is that most of its investment comes from American venture funding. There seems to be a great opportunity for UK investment in these industries; it is risky, but the returns can be immense if you get it right. There seems to be a lack of willingness among UK financial institutions to invest in our indigenous gaming industry.

Christopher Harvie: I have read quite a bit about Grand Theft Auto. Given the degree of moral hazard involved in its plot, I could well believe that much of the investment for it came from Sicilian-American interests in Chicago. It seemed to me to be quite a horrendous thing. We get into enormous knots with health and safety, for example kids who go swimming having to be supervised by men in dayglo suits, but Grand Theft Auto seemed to be foul in the extreme. One of these little men in Calton Square in Edinburgh said, “I make lots of wee men and then kill them.” The game did not seem to me to be a very pleasant thing. Okay, we have a murky track record of selling opium to the Chinese and fire water to the North American Indians, but I am not altogether sure that these games are much better.

The Convener: It is important to stress that only 3 per cent of games sold in the United Kingdom have an 18 certificate; most of the games are not of that type. Grand Theft Auto has an 18 certificate; it is not meant for people under the age of 18. There is a certification system for games and it is important that adults look at the certificate when they buy games for their children, to ensure that they do not buy inappropriate games. That said, 97 per cent of the games in this huge industry are suitable for people under the age of 18. The computer game that I play mostly is Scrabble.

Gavin Brown (Lothians) (Con): The gaming industry is a potential jewel in the crown: we could be market leaders, if we are not already. Are you proposing that we take practical steps in relation to the centre of excellence? Should we send a letter? Is there anything we could do to help?

The Convener: I am happy to consider whether a letter to the Department for Culture, Media and Sport would be helpful. Dundee certainly has a strong claim for the centre of excellence. However, there are another couple of contenders: there is strength in computer gaming in the north-west of England around Manchester, and in Guildford. If a letter of support from the committee would boost the University of Abertay’s chances of getting the designation, I would be happy to send one.

That concludes our business. Thank you all. I look forward to seeing you on the train to Croy, and then in Kirkintilloch, next week.

Dave Thompson: I congratulate the convener on an excellent agenda, and on closing the meeting at half past 11.

Meeting closed at 11:31.

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