ECONOMY, ENERGY AND TOURISM COMMITTEE

Wednesday 11 March 2009

Session 3

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CONTENTS

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ECONOMY, ENERGY AND TOURISM COMMITTEE
9th Meeting 2009, 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)
*Stuart McMillan (West of Scotland) (SNP)

COMMITTEE SUBSTITUTES

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

*attended

THE FOLLOWING ALSO ATTENDED:

Nigel Don (North East Scotland) (SNP)

THE FOLLOWING GAVE EVIDENCE:

Stephen Adamson (Scottish Power)
Professor Ian Bryden (SuperGen Marine Consortium)
Max Carcas (Pelamis Wave Power Ltd)
Professor David Gani (Scottish Further and Higher Education Funding Council)
Paul Lewis (Scottish Enterprise)
Göran Lindgren (Vattenfall)
Jim Mather (Minister for Enterprise, Energy and Tourism)
Neal Rafferty (Scottish Government Business, Enterprise and Energy Directorate)
Dr Alison Wall (Engineering and Physical Sciences Research Council)
Professor Robin Wallace (University of Edinburgh)
Dr Michael Weston (ITI Energy)

CLERK TO THE COMMITTEE

Stephen Imrie

SENIOR ASSISTANT CLERK

Katy Orr

ASSISTANT CLERK

Gail Grant

LOCATION

Committee Room 2

Scottish Parliament

Economy, Energy and Tourism Committee

Wednesday 11 March 2009

[THE CONVENER *opened the meeting in private at 09:23*]

09:39

Meeting suspended until 09:45 and continued in public thereafter.

Interests

The Convener (Iain Smith): We now open the public session of the ninth meeting of the Economy, Energy and Tourism Committee in 2009. Agenda item 1 is to welcome Stuart McMillan to his first meeting. Welcome, Stuart. I hope you enjoy your time on the committee; I am sure you will find it very interesting. However, before you can participate, you will have to declare any interests that you may have.

Stuart McMillan (West of Scotland) (SNP): Thank you, convener, for your welcoming comments. I have no interests to declare.

The Convener: I believe that Christopher Harvie has amended his entry in the register of members' interests.

Christopher Harvie (Mid Scotland and Fife) (SNP): Yes. I have become a shareholder in Argyll Publishing, of Glendaruel, Argyllshire—with only Mike Russell as a neighbour.

The Convener: Well, good luck on that one; that is all I can say. But thank you for making that declaration, which will be noted for future reference.

We also welcome a guest MSP this morning—Nigel Don.

Energy Inquiry

09:46

The Convener: The next item is the next session of our inquiry into Scotland's energy future. I welcome the members of our first panel, and invite them to introduce themselves before we open the meeting to questions.

Dr Alison Wall (Engineering and Physical Sciences Research Council): I am associate director of emissions programmes for the Engineering and Physical Sciences Research Council—which, of course, covers energy.

Professor David Gani (Scottish Further and Higher Education Funding Council): I am director of research policy and strategy at the Scottish funding council, and I have responsibility across the piece for subject disciplines in Scottish universities and for research training and knowledge transfer.

Professor Robin Wallace (University of Edinburgh): I am head of the institute for energy systems at the University of Edinburgh, and a co-director of the energy technology partnership. I am also involved with the UK Energy Research Centre. I am also principal investigator in the SUPERGEN marine consortium, and I am here bringing experience of the community that delivers the research rather than funds it.

Dr Michael Weston (ITI Energy): I am technology analysis manager at the intermediary technology institute, ITI Energy. I have been there for four years. I bring experience of the ITI Energy experiment.

Paul Lewis (Scottish Enterprise): And I am managing director of industries at Scottish Enterprise. I am responsible for our work with all the key sectors and the economic strategy. I am also currently the chief executive of ITI Scotland.

The Convener: I thank the panellists for coming. We will try to keep this session to about an hour, because I know that a couple of the panellists have to get away. I ask committee members and panellists to keep their questions and answers as brief as they can. I remind the panellists that at this stage in our inquiry we are hoping to develop specific recommendations for our final report. If you wish to see any particular recommendations made, please try to mention them while answering questions.

I will start with a fairly general question about the strength of Scotland's research base in energy. How good is our research base? Does it have breadth and depth? Are any bits missing, and are there limitations that we should address?

Professor Gani: It might be appropriate for me to give the committee an overview, and I will start with a broad analysis.

The Scottish funding council, together with the universities, has been investing in research for a number of years now, using a mechanism called research pooling. Some of our investment has been targeted in science and engineering, and also in the social sciences and economics. We have just conducted a UK-wide research assessment exercise, in which every single academic research leader in the UK was assessed. That was quite a difficult process, but Scotland has done extremely well. It has improved its position within the UK. Areas such as physics, chemistry, the biological sciences, informatics and computer sciences are now better, on average, in Scotland than they are across the UK as a whole. There have also been improvements in some areas of engineering, but the overall position is still emerging. There is room for improvement, certainly in the international profile of engineering.

I do not want to say any more than that, but I should say that we had a big investment in something called the Scottish research partnership in engineering, which gave rise to the Scottish energy technology partnership and also involved two other research pools. A research pool is usually a pan-Scottish collaboration, or a collaboration involving many Scottish universities, that is deep-rooted and has governance structures. Those research pools have added quality and profile to the area, and have led to opportunities for knowledge exchange with industry. There is a lot of hope that they will deliver opportunities that have been difficult to deliver before.

Clearly, we need to invest in certain areas of energy research if we want to focus on underpinning Scotland's priority industries. I am not an expert on where those areas might be, but I know that there are opportunities for those investments to be made. That should be a high priority for the Scottish Government.

Dr Wall: I will try to answer from a research project point of view. The ESPRC funds across the UK. We look for excellence in the projects that we fund and there is considerable leadership in those that we fund in Scotland. One of our flagship programmes is SUPERGEN—sustainable power generation and supply—and there is Scottish leadership and major engagement in at least half of the major SUPERGEN research consortia including wind, marine, storage and networks.

Recently, a lot of funding has gone to the University of Edinburgh and Heriot-Watt University in relation to carbon capture and storage, and considerable leadership has been shown in that area as well. The companies that are leading on the recent projects that have been announced by the Energy Technologies Institute were able to choose the leading university groups that would engage with them as partners, and they chose the University of Strathclyde and the University of Edinburgh. Again, that shows that there is some major leadership and excellent research going on in Scotland.

Dr Weston: ITI Energy commissions research, and we have found research pooling to be tremendously useful. It has certainly strengthened Scotland's position in the projects that we have taken forward and has made an impressive shopfront for Scotland's capabilities. I would love that area to expand.

Professor Wallace: One of the features that distinguishes the UK and Scotland in our energy research is the collegiate manner in which it now proceeds. The SUPERGEN consortia and the research pools that Professor Gani referred to have brought about a new way of working that those of us who have been around for a while have not seen before. There is a synergy and a geometric addition of effort and outcomes that is perceived by European partners and countries around the world as exemplary. Many countries are trying to emulate the framework that now exists in the United Kingdom and Scotland.

Lewis Macdonald (Aberdeen Central) (Lab): I am interested in how we can translate research strengths in certain areas into support for the development of particular technologies. Where does the Energy Technologies Institute fit into that bigger picture? We are looking at a pipeline of support for different stages. The universities support the initiation of many projects, but the step up to the next stage is of critical importance, and I would like to know about the role of ETI in that regard. Perhaps Michael Weston could talk about the role of ITI as well.

Professor Gani: It all starts in the universities and colleges, and there are a number of infrastructural requirements before you can get good value out of private and public investment in knowledge creation. We need excellent laboratories and the sorts of partnerships that have been referred to so that we can maximise the interaction. The arrangements must be multidisciplinary, particularly in relation to energy research. We need superb training facilities for undergraduates and masters students and particularly for PhD students in this area. Once all that is in place, there must also be industry pull—that is a generic comment—and in some areas of energy research there is good industry pull and good interaction. From that point on, there is an expectation that knowledge can be translated into applications that contribute to economic

prosperity, but the public sector cannot deliver that on its own, nor should it.

Over the past three or four decades, we have seen the downfall of the corporate laboratory, by which I mean the in-house research and development work that was done by big industrial players, which had very natural ways of interacting with universities. Instead of that, those big corporate labs have pursued pre-competitive research that involves companies working together—that is particularly the case in the pharmaceutical industry. That is relevant because it means that we now have many more small and medium-sized enterprises that tend to outsource some of their research and development. Because there are many more of those companies, there need to be structures that can bring common interests together in a way that provides an interface that the universities can interact with. In Scotland, we have about 20 universities and higher education institutions, which are all autonomous. They are not a single entity and they have their own strategies and agendas, so we need structures to pull together the agendas for knowledge translation. We also need resources that are specifically aimed not only at research quality and excellence, project funding and industrial relevance—respectively the responsibilities of the funding council, the research councils and the enterprise agencies—but at ways of nurturing and developing the application of research in the bits in between our main responsibilities. That is a fairly big issue. I set that out as background to the answer that Robin Wallace will give to the question that you asked.

Dr Wall: I will have a first go at answering the question and Robin can add some specific detail.

The ETI is one of the partners that we would work with on the development of technologies. We should not forget the Technology Strategy Board, which is the research councils' major partner. For example, we and the Technology Strategy Board, are funding a Scottish Power programme that is examining aquifer storage for captured carbon. We have partners in the energy area besides ETI.

In terms of ETI, there was university engagement to help set the agenda for the first programmes in offshore wind and marine energy generation, and the work that the SUPERGEN teams and the UK Energy Research Centre did on road mapping, for example, fed into that. The projects that have been announced so far have university engagement. If I remember correctly, the University of Strathclyde is involved in two offshore wind power development projects—nova and helm wind—and the University of Edinburgh is involved in the reliable data acquisition platform for tidal—ReDAPT—project. So far, there has been good engagement.

The innovation chain is not a simple, linear model, so we do not simply hand over a project to another partner on the landscape. As we come to the next stage of funding for our sustainable power generation and supply programme, for example, we are looking to see what else the research councils need to do, working with whatever partner is appropriate, to help the translation of research and to get researchers alongside the increasing number of development and demonstration projects so that they can get involved in those real-world situations and can take the research challenges back to their research teams.

Robin Wallace has experience of that from the other side.

10:00

Professor Wallace: Yes; I have participated in, rather than simply observed, much of the planning that has gone on. An example of that is what might be referred to as the third phase of the sustainable power generation programme, SUPERGEN. Well in advance of the period of transition, the funding councils are engaging the research community and the industrial sector in planning the appropriate next moves. There is now an inherent process that engages the wider community in the planning of the next priorities, which is very much welcomed.

I make one general point to Mr Macdonald. As Alison Wall said, the innovation curve or chain is not necessarily linear—it may have a slope, because the costs of technology drop as the volume of the technology that is produced increases and goes from research through development and demonstration into deployment. The most important feature of that curve is that the support that is available for the best concepts must not be discontinuous. There are quite a large number of UK and Scottish agencies acting on the need to support technologies from concept to widespread deployment down the curve. You may be aware of some recent reports from the Institution of Mechanical Engineers that point to a potential funding gap at the pre-deployment stage. However, I think that that is more a matter for the second evidence session today, at which developers will be present. My one observation is that, for smooth transition, there must be no discontinuity in the access to funds with which to continue to develop the technologies.

Paul Lewis: I echo the important point that both Robin Wallace and Alison Wall have made about the innovation process not being linear. Scottish Enterprise—I will talk about ITI Energy as well—is involved much more heavily at the stage of proving development. Then there is demonstration in a commercial setting to allow the market ultimately to deploy the technology. We use a

range of tools to do that, from our co-investment funding with companies to things such as the proof-of-concept activities that we undertake with universities. The role of ITI Energy is to take a market-focused view on where there are opportunities for Scotland regarding the technology base. David Gani made the point that Scotland's current corporate landscape does not have the amount of R and D investment from large companies from which other economies benefit. ITI Energy compensates for that by providing some means of promoting market-focused R and D in certain technology areas.

There are opportunities for us to do much more with bodies such as the Technology Strategy Board, which Alison Wall mentioned. That is a major funder of innovation at the UK level. We have done some good work with the TSB in other sectors and I think that we could do more in the energy sector, with its focus on development and deployment. Michael Weston might want to talk specifically about ITI Energy opportunities.

Dr Weston: It is difficult for me to follow that. ITI Energy was set up to bridge the gap left by the lack of corporate R and D investment in Scotland. We have moved forward on that, but the amount of money that we receive is not sufficient to allow us to take programmes into the deployment phase—we always focus on the prototypes. To return to the question, any discussions that we have had with ETI have therefore focused on the idea that we will take a project so far and then pass it on to someone else for the deployment stage. As we move towards greater integration with SE, any potential gaps or drop-off points will be covered.

Lewis Macdonald: Has ITI Energy succeeded in meeting that objective over the four years for which you have been involved?

Dr Weston: We have managed to take to the point of prototype programmes that have not required large amounts of money to take to the deployment stage. Some of our projects are now reaching that stage. The composite pipeline system is a good example of that, but it requires a serious amount of investment to take it to the next stage. So far, we have taken two programmes to an end point and licensing. In both cases, secondary investment was secured to take them forward. We feel that we can demonstrate that we have met that objective. Larger programmes will require larger investment and will require more integration with the next stage of funding, but we feel that we are making good inroads on that.

Lewis Macdonald: Essentially, you are saying that ITI Energy in its current form has been able to take projects forward over the past four years but lacks the capital to take them further.

Dr Weston: That is pretty much what I am saying. We have the ability to undertake some projects but not others that we believe will have higher impact. Obviously, we face a classic risk-reward issue at the end of the day.

Paul Lewis: That is a valid point. If we think about the innovation spectrum, the ITI was never created to take ideas from inception to full commercial deployment. The ITI bridges a gap by identifying market technologies and creating and proving platforms that can then be deployed commercially in the marketplace. We recognise that commercial deployment might require considerable further investment from both the private and the public sector. The ITI was always designed to hand over activity to other parts of the public sector, such as Scottish Enterprise, which can use its R and D funding and investment funds for commercial companies to take things through.

Michael Weston makes the valid point that some interesting areas of technology that the ITI is considering will require substantial investment if they are to be commercialised. The challenge in Scotland is to increase the amount of risk capital within the economy overall. Clearly, that would benefit ITI Energy and other initiatives in other sectors.

Lewis Macdonald: However, ITI Energy was not intended to be a short-term fix or temporary arrangement. Michael Weston has described how ITI Energy has succeeded in bringing projects to the next stage, where they require additional funding. I do not understand why it has been decided—the minister tells me that the decision was made not by him but by Scottish Enterprise—to scrap or cease to operate ITI Energy. How will those early stage, pre-commercialisation projects be taken forward in the absence of a dedicated vehicle for dealing with them?

Paul Lewis: Let me answer that directly. We have not decided to scrap ITI Energy, but to integrate it into Scottish Enterprise's operations. We have been clear that we will continue with ITI Energy's core delivery programme and the other market teams that the ITI has in place, and to commission new programmes. We recognise that the gap that ITI Energy fills—and will continue to fill—is an important issue for the Scottish economy. We are certainly not scrapping the ITI in any shape or form.

We are integrating the ITI into Scottish Enterprise's core operations to ensure that the process, from identification of opportunity to its commissioning and management to its ultimate commercial exploitation, takes place in a proper and seamless way. Given the role that Scottish Enterprise plays in investing in demonstration facilities and ultimately in the exploitation of opportunities—for example, Fife energy park, our

demonstration facilities in the hydrogen office, our work with the individual firms that are invariably the research partners of the ITI—a natural fit exists between initiation and exploitation. In bringing the ITI into Scottish Enterprise, we are certainly not scrapping the ITI; we will continue to run ITI programmes.

Lewis Macdonald: There is clearly continuity between those activities. The question that the committee might ask is why, having seen the ITI as a valid standalone organisation for meeting a particular need over the past five years, Scottish Enterprise has now taken the opposite view.

Paul Lewis: I guess that the answer is that you are right that, when the ITI was established back in 2003, it was set up specifically as a standalone organisation. However, the ITI has always operated as a subsidiary of Scottish Enterprise. The ITI was a standalone organisation in one sense, but it was very much part of the Scottish Enterprise family. At that stage, Scottish Enterprise had a number of subsidiaries, not least of which were the local enterprise companies.

Since the ITI was set up, a few things have happened. First, the Government's economic strategy crystallised the challenges. Clearly, increasing business R and D is a core challenge for both the ITI and Scottish Enterprise. In addition, we have had a review of the enterprise networks and a revised focus for Scottish Enterprise. Scottish Enterprise is investing much more heavily than we were five years ago in some of the key sectors of the economy, not least energy. A natural fit now exists between the ITI and Scottish Enterprise, which probably did not exist five years ago when the ITI was established. By integrating, we can achieve more impact from such activity.

Lewis Macdonald: I have two simple factual questions to finish dealing with the issue with Paul Lewis. Does what you have said mean that you expect next year's funding to be increased from this year's funding for the areas that ITI Energy covers?

Paul Lewis: We are considering the budgets for the ITI, which we will confirm by the end of this month. I certainly expect new programme activity beyond what the ITI has run in the past year.

Lewis Macdonald: When the committee was in Aberdeen last week, it was clear from some of the people from whom we heard that the presence of ITI Energy so close to where the energy industries operate is hugely appreciated. Do you intend ITI Energy to continue to operate from Aberdeen?

Paul Lewis: The short answer is yes. Our energy team is headquartered in Aberdeen and ITI Energy will continue to be headquartered in Aberdeen. Both those groups operate pan-Scotland and it is important that they continue to do so, but Aberdeen is and will continue to be their base.

Christopher Harvie: Let us assume that a project has reached the point of technical viability and that you want to put it into production. What if that can be achieved only by approaching a European company? In the North Sea oil period, we had Ferranti, GEC and so on. We no longer have them. Wavegen is now part of Siemens. Does that raise the problem of a different research culture, a different governmental relationship to research and different resources, which mean that production is likely to be developed further outside Scotland?

Paul Lewis: The way in which the ITI model operates—we can also talk about other strands of the research base in Scotland—means that, when a programme is considered, the key decision that needs to be taken is whether Scotland can pick up the technology and run with it. If the route to commercialisation is unclear, we in the ITI probably should not start the programme, because it will become an interesting research activity that does not reach the end point that we have in mind.

The commercial route can be achieved in three principal ways. One way is establishing a new company—a new start is an option. The second way is licensing activity to an existing Scottish company—ITI Energy has done that. The third way is engaging with an international player, but that is done by bringing that player to Scotland rather than licensing it to do activity outwith Scotland. ITI Life Sciences has a successful development arrangement with a company called Cellartis, which is from Sweden. Cellartis was originally a research provider to that ITI. As part of that, it established a presence in Dundee. It is now an established part of the life science community in Scotland and is a commercial licence holder. It is not a Scottish company, but it does its development work in Scotland.

All three routes—new starts, licences to existing Scottish companies and attracting international companies to Scotland—are considered. There are ways of meeting the challenge that Christopher Harvie presented. We would not seek to develop technology that could be licensed only internationally, without any benefit to Scotland.

Christopher Harvie: I have experience of working in a German Land with high mechanical engineering and electrical engineering performance. Relative to its population, Baden-Württemberg trains five times the number of technicians that Scotland does. Given that technological manpower—the spanner men who adapt such research for volume production—is much thicker on the ground abroad than it is here, I am afraid that the automatic response that will

follow development, once a product is technologically feasible, is that adaptivity into practical production will go where it is available easily and with a highly skilled labour force. Scotland might have had such a labour force in the 1970s, but I do not believe that it does today.

10:15

Professor Wallace: There is a break point or watershed in the development of a technology where it moves from a concept in academia, through early small-scale proof of concept, to a product that increasingly has to take stakeholdings from other agencies and, eventually, realise private stakeholding. It is absolutely appropriate to try to ensure that we capture for Scotland and the rest of the UK as much of the commercial opportunity as possible to exploit new technologies and opportunities in the energy domain, and the universities have good legal, commercial and licensing organisations that protect a development from the outset to the end. However, considering some of the energy targets and the timescales within which we must realise them, we must not lose sight of the fact that we need world-class research output to create and underpin the breakthroughs that will give us the step and market changes. That kind of research might best be brought about by international co-operation with the best scientists in Europe, the United States and other places. We have seen as a feature of the past five or 10 years that the early funding agencies and research councils are keen to internationalise their programmes and activities to gain the benefit of experience across the international community.

Stuart McMillan: Will there be any cost savings with ITI being incorporated fully into Scottish Enterprise?

Paul Lewis: Undoubtedly there will be some efficiency gains from integrating ITI with Scottish Enterprise.

Rob Gibson (Highlands and Islands) (SNP): I want us to think about the attraction of funds from UK sources for the kind of developments that we are talking about, bearing in mind the climate change targets, the geographical fact that 40 per cent of Europe's renewable energy sources are in and around Scotland, and the potential for carbon capture and storage here. Could you address the question of opportunities to attract funds from the UK's research councils and bodies such as the Energy Technologies Institute, and could you build up a picture of how well Scotland does? Do we know at this stage how much funding we attract into Scotland beyond what is initiated here by our collaborative research groups and so on?

Professor Gani: It might be useful for me to start off. The Scottish funding council provides the main quality research grant, which is awarded as a result of the research assessment exercise. The grant is for staff and building facilities rather than for projects, and we spend about £200 million a year on it. On the basis of that investment, the Scottish universities go and get approximately another £500 million or £600 million from the UK research councils, charities and business. Although there is a little bit of overlap there, as of last year they also do £315 million of knowledge transfer activities—contract research, continuing professional development, licensing actitivies and the like—so they are pretty busy and they gear heavily on Scottish public investment and research.

On average, Scottish universities outperform the rest of the UK in just about every area of endeavour. Alison Wall will correct me if I am wrong, but in areas such as physics and chemistry, biological and life sciences and medicine, Scotland does better than the UK average. Typically, we are getting between 12.5 and 14 per cent of the total available UK budget in any area. That has implications for the infrastructure that is provided to our universities, but they are hugely successful nevertheless.

If you start looking at sub-areas, the picture varies enormously. Given that we are talking largely about energy and renewable energy in particular, Alison Wall is probably better placed than I am to comment on how Scottish universities do in attracting money from the EPSRC. However, some of the players that have already been mentioned—Strathclyde, Heriot-Watt and Edinburgh—do very well.

Dr Wall: We cannot give the figures because most of our major awards, such as those made through the SUPERGEN initiative on sustainable power generation and supply, do not go to a single university. Many of the major collaborations involve universities in Scotland, England and Wales, so it is not a trivial thing to sit down and work out the figures. I am not even sure that we could, because when we award the grant, we award it to one university to act as a financial hub. There is a set work programme on day one, but we expect that to change, and to follow the most advantageous lines of research as the project develops over the four years. It is not a simple thing for us to get those figures.

We had a quick look, and Scotland seemed to be around 10 or 15 per cent overall. However, that is not a very good figure. That is because SUPERGEN is a big initiative—£2 million to £6 million—and although some of the groups are led by Scotland on finances and some of them are led by Scotland on the research direction, the finance

hub is in England. Our figures are difficult. Many of the major consortia have big involvement from Scottish universities, especially Strathclyde and Edinburgh on carbon capture and storage. Storage work is also being led at Heriot-Watt and St Andrews. If we look across the whole portfolio, we see major engagement by the Scottish universities, but I would struggle to put a nice figure on it for you.

Rob Gibson: We have the question of the Scottish collaborative research groups, but we ought to get a picture of the collaborative research that includes people in universities in other countries. Even some examples of that would be helpful to illustrate the points that you have just made. I do not know whether you can do that, but we could perhaps get those examples from other sources.

Dr Wall: We will certainly give you the list of the grants that we funded—you are welcome to have a look and see who the partners are. If it is relevant to you, we can pull out from our database the co-investigators who come from Scotland, so that you can see the sort of work that is going on here. What is hard for us to do is to put the pound signs against it.

Professor Wallace: Perhaps this will help as a qualitative rather than a quantitative expression. I think that you are all aware of the energy technology partnership. As part of our early engagement on the international scene, we did a survey of the SUPERGEN consortia that we either lead or are part of. By our analysis, Scottish universities in the ETP lead six SUPERGEN consortia and are partners and contributors to—I think—another six. I think that there are now 14 in total. We are quite heavily engaged either in the leadership and direction of consortia or as participants in consortia that are led from elsewhere in the UK. That is a nice position. It is well earned, and we are justifiably proud to be there.

I will expand a bit on the marine energy context. Phases 1 and 2 of the SUPERGEN marine consortium ran consecutively for four years initially. We are now six months into the second year of phase 2, so we have been doing this actively for about five and a half years, and a bit longer if the lead-up is taken into account. It has attracted a lot of interest to the things that the UK does in that domain, and it has catalysed many UK, European and international relationships that have allowed us to lever in other sources of funding from Europe and other partnerships around the world.

I think that Mr Gibson asked about the extent to which we engage with research initiatives in other countries or research funding streams from other countries. The SUPERGEN marine consortium is engaged in an advisory capacity and we have an interactive staff, student and knowledge exchange, to varying degrees, with other organisations in 10 or more countries worldwide—notably, in Canada, the east coast United States, Taiwan and, increasingly, China. As I mentioned earlier, many of those countries are trying to emulate the marine energy sector in Scotland and the UK within their own funding structures, academic and industrial bases and energy needs. That is an exciting and rewarding position for us to be in. However, it means that we must work hard to sustain any first-mover advantage that we have in order to remain at the forefront and not be overtaken.

Paul Lewis: The energy technology partnership, which has been mentioned a few times this morning, is an example of research pooling with the explicit objective of developing international alliances. As Professor Wallace has described, China, India and Texas are particular areas of focus for the energy technology partnership at the moment.

Marilyn Livingstone (Kirkcaldy) (Lab): I would like to explore a bit further with David Gani how well we are doing in Scotland at supporting energy-related research. What percentage of the funding that goes into energy-related research comes from the funding council? You have talked about the funds from the funding council attracting £500 million or £600 million from the United Kingdom. Does that funding attract any other matched funding from Europe or elsewhere?

Professor Gani: I think that I can answer your first question, although my answer will not be very satisfactory. Because universities are autonomous institutions and we give them their quality research grant to use as they see fit in pursuing their own strategies, it would be difficult to track how much of that grant is spent on energy. Nevertheless, I want to give you a useful answer. If I were the vice-chancellor of a university, I might be able to identify as energy research certain areas such as the one that Professor Wallace is involved in. However, there would be other related areas—for example, in the social sciences—that might involve discussion of how pylons affect people's willingness to live in a certain area or what wind turbines look like if they are just outside someone's front door. It would be very hard to trace all the research projects that focus on the whole range of related issues.

Because of initiatives such as the Scottish research partnership in engineering, which has had energy as a major focus, and because we have six universities—Aberdeen, Heriot-Watt, Strathclyde, Edinburgh, Glasgow and St Andrews, which is pursuing research on fuel cells—that all have a significant interest in energy, I would gauge that the level of funding for such research is

higher, on average, in Scotland than in the UK as a whole. The evidence for that is the fact that, a few years ago, the EPSRC was distributing its resources in such a way that Scottish universities were gaining a very large chunk of that funding. However, as that funding was allocated at an institutional level, it was not necessarily all used for energy research. We would have to ask each university to provide us with an estimate, which would be a bit rough and ready.

Could you please remind me what your other question was?

Marilyn Livingstone: I asked what European funding is attracted by the initial sum that you spend. However, I presume that your answer to that question will be the same.

Professor Gani: No. Robin Wallace mentioned the interaction that takes place at an international level. Our infrastructural money from Scotland underpins universities' ability to undertake the research in the first place. They get project money from Alison Wall's organisation, the EPSRC, and other bodies. Increasingly, there are funding opportunities with the Technology Strategy Board, which now funds knowledge transfer activities very effectively.

10:30

There has always been a European agenda through the framework programmes, although it is not always financially viable for UK universities to get involved in those programmes, because they do not pay a large proportion of the real costs of doing the research. However, when resources are thin, the UK universities, including Scotland's universities, have a powerful incentive to try to access that resource, because it might fit strategically with something else that they are already doing, in which case there will be economies of scale.

In the area of energy—on which I am not an expert, I hasten to add—there are huge opportunities from engaging with the European Union and the European Institute of Innovation and Technology, or the EIT, as I believe it is called—the same as the ETI with two letters reversed, just to add confusion. One of the institute's main themes is energy. That is generating for Scotland and the UK an overlap of strategic initiatives that provide a real opportunity for gearing and for joining up, not just in the UK, but in the European Union. Scotland is very good at that.

Marilyn Livingstone: I understood that from Robin Wallace's point. If you cannot quantify the amount of your funding that goes on energy-related research, I presume that it will be difficult to tell us how much European funding we attract. As universities work individually to attract that funding, you will not be able to give us an exact figure for European funding. We are trying to get a picture of how much money goes into energy-related research in Scotland—that is what I am driving at.

Professor Gani: The reason why we might be able to tell you much more accurately how much comes from Europe is that there is a different audit trail that comes through our books at the funding council and through the UK Higher Education Statistics Agency. We might be able to tell you that. However, you are absolutely right that I cannot tell you what Scottish universities are spending.

Professor Wallace: I will try to help by making an observation and then setting out almost a case study. The joint research institutes that are part of the Edinburgh, Glasgow and northern research partnerships report through a board to the Energy Research Partnership. That reporting involves key performance indicators, which include issues such as new European funds that have been attracted. There is an osmotic process that accumulates the data, among a great deal of other data, and ultimately feeds back through the reporting structure to the advisory groups and the SFC. The data will emerge in due course, although, at the farthest edges, the information is fairly granular, so it perhaps takes some time to come together.

I will give a case study that might exemplify what Professor Gani has said. One of the people whom Edinburgh appointed to the joint research institute in energy with Heriot-Watt, using the funding that the SFC made available, subsequently foraged from Brussels, and now leads, the flagship marine energy programme in the seventh framework programme, which is called EquiMar. That was a textbook process, with the correct effort at the correct stages. The proposal was ranked second or third of 233 and the programme now operates throughout 14 member states with 23 partners. That is another European flagship programme that is led from the universities and the ETP in the centre of Scotland. That is only one example from my experience. The committee should remember that there are another four joint institutes in the Edinburgh partnership and another three regional partnerships in Scotland, so there must be many more examples. I know of others in Professor Gani's areas of investment in the pooling that have produced similar results, but at this stage it is difficult to have the complete picture.

The Convener: The committee appreciates that, because of the different funding channels, it will be difficult to get an accurate picture of exactly how much money is available for research into energy in Scotland. However, it would be helpful if you could provide us with information about specific

issues such as European funding. Can Alison Wall give us a ballpark figure for how much the EPSRC funds in total? Roughly what percentage of that figure is spent on energy-related research?

Dr Wall: I shall get back to you with the total funding figures, for the purposes of comparison. The total figures for energy that I have brought along are for all the research councils, as we all work together. Last year, we spent about £75 million in total on energy.

The Convener: Is that spending across the UK?

Dr Wall: It is for all the research councils—we have a joint programme and report our figures together. We hope that spending in the year that is just ending will be up at between £90 million and £100 million. We will produce the figures in a few weeks' time.

The Convener: Does any of the funding go to research into energy efficiency, such as building research?

Dr Wall: Some of it does.

The Convener: Roughly how much goes to such research?

Dr Wall: The figure is quite low—about £4 million per year. One of the targets and key priorities of the programme in this three-year spending review period is to grow spending on energy efficiency and demand reduction.

Marilyn Livingstone: What part do Scotland's colleges play in this area? I know that they play a major role. It would be interesting for us to see what funding is going to colleges. I am mindful of the time, so you may come back to us on the question.

Professor Gani: We are talking largely about a research agenda. Scotland's colleges are not funded for that.

Marilyn Livingstone: I intended to ask a much bigger question about skills training, but Christopher Harvie covered some of that. My question is about collaboration. Christopher Harvie talked about the technician level, to which I am alluding. We have been told that there are shortages at that level. First, how much money is being spent in Scotland's colleges on training at technician level in the area? Secondly, when we were in Aberdeen, we heard that there is a pool of skills that could be transferred from the oil and gas sector into new technologies. Has funding been set aside for that, and, if so, how much?

Professor Gani: The skills committee of the Scottish funding council is aware of the issues that you raise, and I know that they are being discussed. I read the *Official Report* of the committee's previous meeting, at which the issue was addressed, and will follow it up. I will do what I can to get back to you on the specific issue of how much is spent on skills that underpin renewable energy.

Gavin Brown (Lothians) (Con): In his opening statement, David Gani painted a healthy picture of our research base. He suggested that it would be a good idea for the Government to carry out a gap analysis but was not in a position to expand on the matter at this stage. In its report, the committee could recommend that the Government carry out a gap analysis on our research base, specifically with regard to energy, or we could give examples of areas in which gaps were identified in evidence. Given the targets that we have for 2020 and 2050, can members of the panel tell the committee—either now or later, in writing—where there are obvious gaps in our research base for energy that need to be tackled fairly swiftly?

Professor Gani: That is extremely useful because there are two dimensions to the issue, to which I referred previously. The first is the point that was made by Paul Lewis and others on the seamless transition from knowledge creation to its application in industry. That connects to my point about the reduction in opportunities for corporate-laboratory interaction. That is an activity gap. Universities are not explicitly funded to turn ideas into applications although, with the knowledge transfer agenda growing in the UK funding councils, including the SFC, and in the research councils, there has been a move in that direction.

On the other specific area, we have output information from the research assessment exercise that clearly tells me which areas we could do better in. However, I am not expert enough in the area to know whether that would be the whole portfolio that is required for underpinning energy research, so I will pass on to Robin Wallace to comment on that.

Professor Wallace: I think that I would like notice. If I confine my answer to areas in which I have expertise, I can point to some gaps, which the second witness panel may be able to describe. I mentioned one, which occurs when a marine energy prototype must spend a year in the sea ahead of qualification for support from the marine renewables deployment fund. I suspect that that is a particular case, but developers and industry colleagues can cite the difficulties that that creates better than I can.

I want to underline something that is not a gap right now but which has the opportunity to become one, if we become complacent in our investment in the infrastructure that delivers the research. Challenges will continue to prevail; technology is moving on, but that defines new questions. All the energy technologies are moving on and down the curve, which defines new research questions and

does not herald the end. The research therefore changes what it has to deliver.

We must also remain competitive on the world stage if we are to attract and retain the best staff to work in Scotland on the creation of the intellectual, energy and economic wealth that we all want. That means that there must be recognition at least of the need for sustained investment in the infrastructure that will deliver the very best international, world-level research: the people and the laboratories—the permanent assets. With those, we can go and win other money on the national and international stage on a project-by-project basis. However, we can attract that money only if the infrastructure is maintained within which we will conduct the research and from which we will compete. That is therefore a horizontal gap rather than a vertical gap in the process.

Dr Wall: We are preparing to do a major international review of energy research in the UK. The review, which will probably happen in 2010, will be one of the research councils' periodic major reviews of subject areas.

I endorse everything that everybody said about gaps. It is important for us to look at the knowledge transfer agenda and get researchers alongside real-world projects as the development and demonstration projects happen, and to ensure that we have the right vehicles, partnership and funding for that to happen. We are also interested in the other end of the spectrum, where adventurous, speculative research is going on in what are perhaps not the obvious areas. We are interested in anyone doing adventurous, speculative work in energy that may make a step change in 20 or 30 years. We want to ensure that we do not lose sight of that.

Paul Lewis: It might be useful for the committee, in considering gaps, to have information on what my colleagues in ITI Energy are doing to have foresight of opportunities and markets in which Scotland could be competitive on a 10-year time horizon. As we consider the gaps in research, it is interesting to take a market perspective. In considering where Scotland's economic opportunities might lie, we need to ask whether we have the right research capabilities lined up to deliver on those opportunities. It is important to use that lens when looking at the question of a gap.

10:45

Gavin Brown: If anyone can come up with some specifics in writing following the meeting, I would be interested to read them. That would help me to think about the things that we should be including in our report.

I will move on to the subject of business expenditure on R and D. Many people were concerned about that during the good times; now that we face troubled times, people are even more concerned about business expenditure on R and D, specifically in relation to energy. Do our panellists have any views on what the short to medium-term future holds in that regard? Do you have any suggestions or ideas about how we try to keep the investment coming? We are on a long-term course and, if we are blown off course for a couple of years, that could hold us back in our medium-term objectives.

Professor Gani: Business expenditure on R and D is poor across the piece in Scotland. It is slightly better in energy, at least in the Aberdeen area, but the challenges of keeping a culture of investment going will be huge, given the economic downturn and given the need over the next period—I imagine—to move towards investment in R and D in renewable energies. Paul Lewis made the important point that we must ensure that overseas companies that wish to invest can locate in Scotland as we develop renewables. There are many very exciting technologies, and there needs to be a major increase in R and D expenditure by business in Scotland.

Paul Lewis: David Gani is right. That is a big challenge at the moment. It has always been Scotland's significant economic challenge, and it remains so. However, despite such challenges, we should continue, as he indicated, to support the existing corporate base in Scotland for investing in R and D. We have a variety of tools to deploy to support it, including R and D investment with companies that enables them to continue to invest and to move up the value chain of economic development. We should ensure that there is sufficient risk capital.

There needs to be more than just a public sector response to business R and D, with more grant support to companies. How do we get more risk capital into the economy? We are experiencing significant demand on our investment funds, particularly the co-investment and venture funds. They are probably trading 100 per cent up on the levels of a year ago. We have put another £5 million into those funds this year, which will be drawn down by companies. That largely concerns early-stage technology companies doing R and D, and there will undoubtedly be continuing demand on those sources of funding. The good thing is that it involves match funding by the private sector, so we can get more money into the system.

As David Gani has said, inward investment continues to be a useful source. Scotland has a very competitive offering and a very good track record in securing high-value R and D inward investment. We are one of the most successful

regions in the world in bringing R and D investment into the country. As I have said, we can use a variety of tools, allied with the work that we do through ITI Energy and proof of concept, to get new companies to take new technologies to the marketplace.

Lewis Macdonald: How would you describe the investment that the energy sector can look to attract from the Energy Technologies Institute over the next three years, say, in comparison with the funding from bodies such as the research councils, the Scottish funding council and Scottish Enterprise? What part of the overall pot will be contributed by the ETI?

Professor Wallace: I do not have an accurate answer or forecast. I can tell you that, through the constituency of the energy technology partnership in Scotland, the Scottish universities, using their connections with industry and with some ETI stakeholders, are sufficiently competitive to bid in virtually all the calls that will be made by the ETI. In those projects that we have already seen and engaged with, we have been quite successful. We have to maintain that success rate in subsequent calls. Ultimately, that provides the sort of answer that you are looking for, although it is a competitive process, so it is difficult to speculate on what that might mean in funding volume.

Lewis Macdonald: Essentially, we will have to ask the ETI.

Dr Wall: I do not think that the ETI would know the answer at the moment. This is a very early stage. The first few projects have been announced; there are some more in negotiation, and careful analysis is going on to position the next set of projects. The ETI would have trouble making that projection.

Professor Wallace: With the current interest and adrenaline in the energy technology partnership to engage with the ETI, we will be pursuing every opportunity to its ultimate conclusion, where there is a legitimate prospect of success.

The Convener: I am afraid that time has beaten us. I thank the members of the panel very much for their evidence. If you can give us any additional information in writing, please feel free to do so.

10:51

Meeting suspended.

10:57

On resuming—

The Convener: We resume with our second panel of witnesses on the energy inquiry. This time we will concentrate on the emerging technologies—specifically, carbon capture and storage, offshore wind and marine energy. I welcome the panellists and ask them to introduce themselves and say briefly whom they represent.

Professor Ian Bryden (SUPERGEN Marine Consortium): I am a professor of renewable energy at the University of Edinburgh. I also lead the university's research programmes on wave and tidal current power. Outside the university, but still in the research sphere, I am research director of the SUPERGEN marine consortium, which looks at wave and tidal current power. I am also the non-executive director of research at the European Marine Energy Centre.

Max Carcas (Pelamis Wave Power Ltd): I am the business development director for Pelamis Wave Power. Our company currently employs 75 people here in Edinburgh. We recently moved into new premises in Leith docks. In February, we were pleased to announce the first-ever order for a marine project from a UK utility.

Göran Lindgren (Vattenfall): I am from Vattenfall, a utility in Sweden, Germany, Denmark and Poland, which is moving into the Netherlands and the UK. My role at corporate level relates to strategic R and D. I am programme manager for the R and D that we are doing on CCS.

Stephen Adamson (Scottish Power): I am CCS commercial manager with Scottish Power. We take carbon capture and storage extremely seriously. My primary responsibility is to look at the commercial opportunities and implications of CCS for Scottish Power. I had the privilege of speaking to some members of the committee at our Longannet power station, and I am grateful for a further opportunity to talk to you about CCS.

11:00

The Convener: I thank the panel for their introductory comments. If members can keep their questions brief and panellists can keep their answers reasonably brief, I hope that we will be able to cover all the areas that we wish to cover.

I offer a particular welcome to Göran Lindgren, who has come all the way from Sweden to give evidence to us this morning. Thank you for taking the time and making the effort to come.

Rob Gibson: We want to look first at the UK Government's competition on carbon capture and storage. How is it progressing? Can it be speeded up? How does Longannet compare to its competitors? Given that Scottish Power is the main Scottish hope, what might increase Longannet's chances of being successful? Does anyone want to kick off on any of those questions?

Stephen Adamson: I will, if I may.

First, Scottish Power is, along with the other two shortlisted candidates in the competition, subject to a competition process agreement with the Department of Energy and Climate Change, which restricts the breadth of the answers I can give. The agreement's objective is not so much to gag us but to ensure that the competition remains competitive and transparent.

It would be fair to say that progress has not been fantastic over the past few months. A number of issues are having an impact, not least of which is the major downturn in the UK and global economies. We have, with our partners in the oil and process industries, developed what we think is an extremely compelling bid based around our station in Longannet.

We are extremely anxious for the competition to progress; it is in the economic interests of both Scotland and the UK to drive the competition forward. Primarily, it will address the question of scale, about which we are all fundamentally concerned. We would look for advocacy and for support at every opportunity in putting the case—to DECC and the other Government departments that are involved—that the competition should be speeded up and progressed to the next stage at the earliest opportunity.

Rob Gibson: Does Göran Lindgren have a view?

Göran Lindgren: Vattenfall is not part of the UK competition but, of course, when it comes to competing for European funding for projects, we have clear preferences when it comes to our own projects, which are currently in the planning stage in Denmark and Germany. We will see the first decisions on larger commitments to those projects later this year.

Rob Gibson: How can we compare those projects to the Longannet proposal? Can you give examples from Germany that compare with where Longannet is at the moment? We know roughly where it is.

Göran Lindgren: I could not hear your question, because there was so much noise outside.

Rob Gibson: You mentioned projects that are being developed in Germany. Can we compare in some detail their state of development with what we know about Longannet?

Göran Lindgren: I can only describe the status of our projects. We have done the first round of geological surveys and are into the preliminary engineering of the plans. We are ready to ask for commercial bids on the plans later this year. Our target is definitely to be in the commissioning phase of the plans in early 2014 or 2015.

Stephen Adamson: The difference comes down to scale. The scale of most of the research and experimental work that is being done at the moment, which is primarily privately financed by energy and process companies, ranges between 1MW or 2MW equivalent up to 25MW: I think Schwarze Pumpe's project is 25MW, but we believe that the scheme for Longannet needs to achieve a minimum of 300MW.

There is validity and value in all the experimentation that is taking place, and we certainly welcome anything that advances the broader understanding of CCS, but the breakthrough will be about how it will operate on a large scale, which we can prove only by building a working full-scale demonstration plant. The value of the UK competition, which is a partnership between Government and industry, is that it will try to clear the investment and knowledge hurdle and give not just Scottish Power but the rest of the power industry—and, perhaps, the transport and storage industries in general—confidence that CCS is investable and viable at the full commercial scale.

Lewis Macdonald: I would be interested to hear how the Vattenfall projects are being financed. What is the input of the Governments of the countries that are involved, and how do you expect the economics of the projects to stack up as you seek to achieve the objectives by 2014-15? Again, a comparator with the UK model would be helpful.

Göran Lindgren: We are going through a technology validation phase, which we decided to run largely on our own. Vattenfall is putting its own money into that, although we have received some small portions of public money from Germany to cover parts of the work. Our current activity is large-scale validation up to the 30MW scale.

When it comes to the demo phase, we are talking about €1 billion of investment for large-scale facilities of 200MW or 300MW of electricity. We certainly expect to put in the major part of that money, but we will need to share the large risks that are involved in deploying new technology on such a scale. We cannot simply build plants on a small scale and then use the same technology on a larger scale. We need to build a plant that has a minimum capacity of 200MW to 300MW of electricity right from the start.

We also need a clear commitment from the public side. We are ready to open the doors for the technology, and there are two ways of doing that. The first and most obvious way is through the legal framework that we are getting in place, and the other is to get some supportive funding to cover part of the risks of building the plants.

In creating CCS projects, it is not only the plants that we need to consider: we must also consider

the transport and storage operations that are connected to them.

Lewis Macdonald: You mentioned a €1 billion investment to carry the project forward to the demonstration level. What scale of public investment do you hope to obtain? Are you running your own competition to determine which of the host Governments will provide the finance to make the project develop? Is that part of your strategy?

Göran Lindgren: We are looking mainly to the European Union for funding. Of course, there is also the possibility of working with member states such as Germany and Denmark, but we do not expect that they will support us with funding. The scale of funding that the EU has indicated—€100 million to €200 million—is a good stake.

Of course, there is a third option, or necessity, for us, which is the necessity for a clear commitment from our technology providers. Not only do we need the public to accept the technology, we need someone to provide us with it, and the big suppliers will also expect to take a substantial share of the risks—although not, I imagine, with regard to funding.

Ms Wendy Alexander (Paisley North) (Lab): I was struck by the expected €1 billion investment that will be required for a 300MW plant. Is Vattenfall trying to secure a first-mover advantage, irrespective of whether it manages to get any of the €1.3 billion that the EU has set aside for the construction of six or 12 plants, or does it intend to await the outcome of that competition before attempting to meet that scale of investment?

Göran Lindgren: We can take some steps before we need to secure public funding. However, we cannot see any way forward without support.

Ms Alexander: There are two economic dimensions to CCS: the capital cost and the operational cost. A more intractable question is what the implied price of carbon needs to be to make the economics of all this stack up. I know that figures are available in the marketplace, but what do you think the carbon price needs to be in the next phase of the emissions trading scheme to make this technology viable?

Göran Lindgren: The price of carbon is definitely going up, not down. We have not been able to specify what the exact price level will be in the first phase; however, we think that, in the long term—by which I mean after 2020—carbon will be about €30 per tonne at today's prices and we expect that, by that time, CCS technology will be competitive at between €20 to €30 per tonne of CO_2.

However, in the first phase, it will be crucial not only to be able to build power plants, put in place transport and storage facilities and establish the necessary co-operation, but to ensure that the first demonstration plants keep operating. They have to continue to be competitive, so we might well need support to keep them running. In that respect, the EU has proposed that funding for such plants will not be made available upfront but will depend on the amount of CO_2 that they actually capture.

Stephen Adamson: There are various views on carbon pricing. One benchmark opinion that is currently in the public domain was published in September 2008 by McKinsey. It set out a cost development curve stretching from the pre-commercial or development phase to a mature market. Although it envisages a peak price of about €90 a tonne in the current—that is, pre-commercial—stage, it suggests that, in the long term and with market maturity and product development, the price level that will be necessary to incentivise investment in CCS will be €35 to €48 per tonne. However, that presupposes that we can kick-start the normal product development cycle for CCS. We are all still pretty much stalled on that; we really need the scale breakthrough.

11:15

I turn to the scale of investment that is required. Scottish Power is a strategic partner in a programme called SOLVIT, which is run by one of our partners, Aker Clean Carbon from Norway, along with SINTEF and the Norwegian University of Science and Technology—the Norwegian centres of excellence for engineering learning. The programme is focused purely on addressing process improvement and trying to remove some of the energy burden that goes into the operational cost. It is funded to the tune of about £30 million. The level of investment that is required for a commercial-scale CCS plant is €1 billion or thereabouts, depending on capacity. That does not necessarily take into account investment in transportation infrastructure and in injection and storage infrastructure that will be required to complete the chain. There is very little point in our having an extremely efficient capture process unless we have some means by which to deal effectively with the CO_2 in the long term.

We really need to make the breakthrough quickly. I hope that I did not pick up what Göran Lindgren said incorrectly, but it is a question of time. Everyone talks about 2020 as being the horizon for when we expect CCS to be deployed commercially. We are talking about a three to four-year construction and commissioning period to build and equip the power plant to be CCS compliant. Ahead of that, there would be a lot of

investment due diligence by the power company or the project developer. If we work back from 2020, that gives us a horizon of about 2014, by which time we would need to see the first demonstration scheme operable at scale. That might allow us a minimum of one full generation cycle across all four seasons of the year, which would give us at least an understanding of the basic operational data. It would take significantly longer than that for us to say that we were fully conversant and comfortable with the scheme.

I turn finally to barriers to investment. At the moment, we find ourselves looking at CCS in the context of how we meet a number of aspects of energy strategy, principally around security of supply and environmental sustainability. It is a bit of a difficult ask for us to develop an investment proposal that can compete for capital against perhaps more traditional or predictable investment proposals, such as for a combined cycle gas station or renewables station, and to ask our board or investors to look at CCS as an alternative. We simply do not have the base of information that would allow us to make a convincing and compelling case for that at the moment. Fundamentally, we will not get that until we have a demonstration at scale.

The Convener: The EU recovery package is currently being considered—I think that some discussions on it are being held today. Will Longannet be in a position to bid for accelerated funding for CCS projects if the package is approved?

Stephen Adamson: We are certainly looking at that, but we have not come to any firm conclusion yet. As with a number of such things, the devil will be in the detail, primarily around eligibility criteria and the deployment timeframe. We are watching what is happening keenly. We expect some sort of outcome towards the end of this month. We will formulate a way forward once we see the detail.

The Convener: I want to explore that further, given that the matter is critical for CCS in Scotland. What are the barriers to your being able to participate in the projects that are accelerated? I think that perhaps five or six of the original 12 projects might be accelerated.

Stephen Adamson: Again, it comes down to the scale of the support that is on offer: €200 million sounds like a lot of money but, in the context of a full-scale demonstration scheme, it really does not come close to the mark. We are, however, involved in a number of other CCS research projects that could benefit from investment at that level. The difficulty that we face is that the original annex C that accompanied the proposal listed Longannet as one of only four eligible UK entries. In a recent discussion with DECC, we argued that that annex be reopened—which, it so happened, would allow the French and Italian proposals to come in—to allow in either smaller-scale schemes or projects that address specific aspects of the chain, such as storage exploration or transportation infrastructure, and which would benefit from that level of investment. It would, in such cases, likely be a more appropriate incentive than it would be for a full-scale, full-chain commercial scheme.

Lewis Macdonald: It is important to make it clear that two of the UK competition bids are based in Scotland. Hunterston is involved as well.

Stephen Adamson: One of the other consortia includes Peel Energy, RWE and DONG Energy. Information in the public domain suggests that the original scheme was based around a new build at Hunterston. However, RWE is now a partner in the consortium and we do not know what impact that is likely to have on the choice of site that the consortium may develop. Tilbury, which is an RWE site, was named in the context of the European proposal and no reference was made to Hunterston.

Lewis Macdonald: I am not going to ask you to comment on the competition, but I am interested in the possibility of more than one commercial-scale demonstration being developed in Scotland or in the UK. The evidence that we received from Göran Lindgren suggested that the UK is well in advance of other European countries in terms of support for projects on that scale. Is there potential for other types of project to come forward, and would those attract public funding? Should the Scottish Government consider supporting additional demonstration opportunities, or is their scale simply too great for that to be realistic?

Stephen Adamson: There are a range of opportunities. The Scottish Government has already supported work on the Scottish regional carbon capture study, which has concluded its first phase and is about to report its findings. There are proposals on the table for a second phase, which would focus on further categorisation or investigation of storage sites, particularly saline aquifers. There are opportunities in the central North Sea that we could exploit on the back of that. There is certainly room for further support and advancement in that area.

Generally, we would welcome any additionality within the world of CCS research. We see that as a fundamental aspect of our business in terms of how it will shape our approach to our generation fleet and mix of generation assets. We are involved competitively and collaboratively, and each project with which we are involved builds our learning and puts us in a better position to make the correct investment decisions in the future.

Christopher Harvie: The principle of carbon capture has been around at least since 1993. It was in the public domain when I finished my book on North Sea oil, so it has taken some time for us to make progress on the issue. I want to ask about the precedents that existed and the extent to which the lessons learned from them have been applied to the current programmes.

I think that the Sleipner field in the Norwegian section of the North Sea has the recovery of carbon discharge from the power stations—

Max Carcas: No. It extracts gas out of the ground, which is separated, and the CO_2 goes back into the ground.

Christopher Harvie: Ah, yes. I think that it was used for powering the on-deck combined-cycle generators.

Göran Lindgren: No. After extraction, the natural gas is cleaned before it is taken out to the grids. A lot of CO_2 has to be taken out.

Christopher Harvie: The other project was the Peterhead project, which BP was taking forward but then cancelled in May 2007, I think. Does evidence from the preparatory work for that project come into your view or do you proceed on totally different lines?

Stephen Adamson: There are some similarities between the approaches, but there is a principal difference in the technologies. I believe that the original Peterhead DF1 project was based on a gas power station. In the first instance, we are looking at what we can do with our coal station at Longannet. In macro process terms, the chemical processes for removing CO_2 are broadly similar, but what we do not know and are trying to understand is how efficient that process is on the specific exhaust gases from a coal power station. The lesson that has been learned from Sleipner concerns the integrity of long-term storage, if we can call 12 years a long term in geological terms. CO_2 has been stripped out of the natural gas there for around 12 years, and around 1 million tonnes a year have been reinjected back into the aquifer. The behaviour of the CO_2 has been monitored through that time, and information has recently been released that shows yet again that the behaviours have been as predicted and expected. That should give us at least an inkling of confidence that the theory works in practice. It is clear that there are concerns about the extremely long-term implications for storage, but we should take a reasonable degree of comfort from the work that has been done on Sleipner to date.

Christopher Harvie: May I ask a question about Pelamis?

The Convener: We will come to that.

Christopher Harvie: Right. I will reserve my question until then.

The Convener: I ask Max Carcas and Ian Bryden to be patient. We will deal with CCS issues and then come on to offshore issues.

Christopher Harvie: On CCS, how much use can be made of the existing pipeline networks in the North Sea, conceivably as a means of pumping CO_2 back into oil-bearing strata?

Stephen Adamson: In principle, the existing infrastructure can be reutilised. Work has been done at Newcastle University on the implications of pipeline change of use. There are questions about the effect that CO_2—particularly wet CO_2, if I may call it that—would have, principally on elastometer joints, but in principle, the existing infrastructure can be reutilised, although we would have to consider each individual pipeline and I think that some kind of remediation or refurbishment plan would be required.

Lewis Macdonald: Surely, in practice, a lot of the infrastructure in the North Sea would have to be replaced because of the risk of corrosion from CO_2?

11:30

Stephen Adamson: We do not know the answer to that—that is what the research is designed to find out. The initial findings suggest that it would not necessarily be the case that everything would have to be scrapped and replaced. I take your point, however, that some of the infrastructure will be more fit for purpose than other parts will be.

Stuart McMillan: Is there an estimated timescale for CCS in the North Sea? How much time will we have before its full capacity has been used? Is that information available?

Stephen Adamson: There have been some initial estimates based around early research on aquifers, but the general opinion is that those are somewhat optimistic. The Scottish regions study will publish more detailed estimates of storage capacity in its report. Our view, which is based on the depleted gas and oil fields, but more on the saline aquifers in the central North Sea, is that we have sufficient capacity to develop the idea of a European storage hub for CO_2 in the long term.

Stuart McMillan: How long is long term?

Stephen Adamson: Our view, in operating terms, is that CCS is a transient technology. Perhaps 100 years from now, our successors will look back and laugh at the fact that we had to generate power from coal in the old days. The timescale will certainly be for as long as we have

fossil fuel in the generation fleet in the UK and worldwide, so for at least the next 40 to 60 years.

Gavin Brown: The witnesses are no doubt aware of the public debate on CCS, particularly on the national planning framework and the longer-term viability of the coal-fired power stations. One argument is that CCS should be mandatory and nothing else will do, and the other is that a CCS-ready approach should be taken.

I am fairly sure which side of the debate Stephen Adamson and Göran Lindgren are on. If I assume that you are on the CCS-ready side, what are the strongest arguments for taking that approach as opposed to the mandatory approach? The committee will have to come up with something on that in its report.

Stephen Adamson: It is, frankly, dangerous to mandate anything that we do not yet fully understand. We hope that policy would be framed around the evolution of such understanding, given the UK competition and the other research activities that are going on. My colleagues are already dealing with the capture-ready approach in the plans for Cockenzie and Damhead Creek.

The extent to which capture ready is considered in applications under section 36 of the Electricity Act 1989, for example, needs to be proportionate to our understanding of the technology and to the reality, or the logic, of the infrastructure that is in place having the ability to support the transport and storage aspects in particular.

Göran Lindgren: In general, mandatory cleaning is a good idea if the economic impact can be assessed, and if that impact is similar for the different facilities. The cost of implementing CCS at different sites will vary a lot—it will be totally unfeasible for many sites, but very feasible for others. We are speaking, therefore, in favour of a more market-based system for introducing CCS, such as the emissions trading scheme.

The Convener: What might be the best system of financial incentives to accelerate the investment in CCS on a commercial basis? For example, should more capital grants be available through schemes such as the EU scheme, or should the price of carbon be forced up so that CCS is more economically viable? Alternatively, will people decide that CCS is not commercially viable and that they will therefore not go down that route?

Stephen Adamson: What would give us the confidence that we need if we, as a power generator, are to invest in CCS? We need to understand how it operates at scale, how long it takes to build the infrastructure and how we integrate that infrastructure into a power station. Further, we need to be sure that we have got the infrastructure that we need if we are to remove the carbon and store it in the long term without, at some future date, having it come back to haunt us in the form of an unexpected emission liability.

In the longer term, we would naturally look to some kind of market mechanism to push the issue forward. The logic is that, at the point at which the cost of emitting becomes marginally greater than the cost of capturing and storing, the investment decision becomes clear. We are considering that and other mechanisms but, first and foremost, we need to understand how the process operates so that we can build a valid case for the level of investment that is required.

Göran Lindgren: It is, of course, important that we see very clear legislation for the operating time of the plans. We think that the ETS system is perfect for the phase that is to come but, with regard to the demonstration phase, we need to share the risks with the public. It is not possible to indicate the level of funding that we will need for such plans, but we cannot take it all on by ourselves.

We are doing a lot of work in this area on our own account—this year alone, we are spending around €100 million without any support from Government. However, public funding would be useful in kicking off the work quickly. If we have no funding from Government, we will have to slow down our product development and gain more certainty about what exactly are the most feasible ways of going forward. That will take much more time than we have allowed things to take so far.

We started this process before 2000. It takes a long time to develop the technologies, and we are now in a phase in which we are validating the technical concepts on capture, transport and storage. We are approaching a phase in which the costs will increase dramatically, because it will involve the execution of large-scale projects. We need to know whether we should slow down a little or continue at our current speed.

The Convener: That concludes our questions on CCS. I thank Stephen Adamson and Göran Lindgren for their evidence and invite them to contribute, if they have something that they want to say, to the next part of our session, which is on offshore renewable energy.

Lewis Macdonald: My first question will be of interest to Göran Lindgren because of Vattenfall's engagement in the Aberdeen wind farm project. However, I am interested in the views of Ian Bryden and Max Carcas on the research, development and demonstration aspects of that project, with regard to the European funding that is on offer, and, by comparison, their views on the effectiveness or value of the European Marine Energy Centre in Orkney and the way in which it has played a demonstration role in wave and tidal power.

Professor Bryden: There is certainly a case for demonstration centres in which full-scale technology can be tested in representative environments. EMEC—in which, as I said earlier, I hold one of the non-executive directorships, with specific responsibility for research—has enabled the testing of full-scale wave and tidal current devices in situ and has given developers access to a working environment, which would be impossible without the level of infrastructure that EMEC provides.

I welcome the concept of the Aberdeen demonstration centre for offshore wind power. It deserves to be supported and to be a success. My experience in Orkney has been entirely positive, and gives me a great deal of confidence that an equivalent wind centre can be successful, too.

Max Carcas: I echo that. Our experience is that EMEC was invaluable to the demonstration and development of our first prototype, which first generated electricity for the UK grid in 2004. If EMEC had not existed, the process would have been much harder. Of course, on the back of that, we were able to secure our first commercial order, which was for a project in Portugal that involved the world's first wave farm. The experience that we gained from building and operating that enabled us to secure the first order for a marine project from a UK utility company, which was from E.ON. We are working on that in Leith, but it will eventually go to EMEC.

Someone can be as keen as mustard on buying our machines, but unless the work has been done to get a site, establish a grid connection and secure the permits, the purchase cannot proceed or will be delayed for two or three years. Therefore, part of our challenge is to encourage people to move forward within that framework to develop those projects, get the grid connections and get the permits so that they can order larger-scale commercial projects. Part of the reason why E.ON was able to proceed with its order was the multiple renewables obligation certificate framework that has been established in Scotland—I understand that a successor scheme is being laid before Parliament.

Lewis Macdonald: It would be interesting to hear about the funding partnership arrangements at EMEC, which involve the Scottish Government, the UK Government and one or two others, and what the relevance of that model might be for the offshore wind project in Aberdeen. At the moment, I believe that there is a funding offer only from Europe, but there might be other potential partners in the wings.

Professor Bryden: There will be differences. The EMEC project receives much of its infrastructure-related funding from Highlands and Islands Enterprise. It therefore has a direct regional role, as well as a national and worldwide role.

If that model had not been put in place, there would not be an EMEC at the moment. I do not think that the structure that was in place would allow funding from a single, central national source. We are very grateful for the role that Highlands and Islands Enterprise played; if it had not jumped up and made it happen and we had had to rely purely on central funding, EMEC would have taken a lot longer to develop.

The model that is used in EMEC is just one among many alternatives that might be found. Of course, it is essential that the funders are willing and enthusiastic. The fact that EMEC had such a funder proved to be instrumental in getting the facility up and running.

11:45

Max Carcas: I cannot answer on the Aberdeen wind farm, but a public-private partnership approach is required to develop the technologies and to get over the hurdles and high costs that are associated with early demonstration projects. Pelamis Wave Power has received about £3 million in public funding support since 1998. On the back of that, we have brought in about £50 million of private sector investment, a very large proportion of which has been spent in the Scottish economy, has been retaxed and has gone back to national coffers. Our experience is a clear example of how a partnership approach can be not only enabling but beneficial economically; we are keen to develop and build on that.

At the moment, the climate for raising investment in the private sector is very difficult, so we are looking at ways in which the public sector can help. One of the key issues for us—it also applies to carbon capture and storage—is pace. Time is our most precious commodity: we need to move forward quickly. There is a great deal that we could be doing to get projects in place, so that we can reach the point that we want to reach with marine renewables, but at the moment we are shackled. Because of the current environment, we must be careful about what we spend.

The Convener: My next question relates to an issue that was raised to some extent in this morning's session on research, but was highlighted particularly in the report on renewables by the Institution of Mechanical Engineers. I refer to the funding gap that appears to exist at pre-deployment or full-scale demonstration stage. The institution estimated that the gap is in the region of £30 million to £50 million—I am not sure whether the figure relates to one year or a longer period. Do you agree that that is where the gap lies? Who should be helping to plug it?

Professor Bryden: There is a gap in that area. I do not know its exact size, but I have read the institution's report and recognise the issues to which it refers. At the early stage, there is inevitably an emphasis on research funding at university level. That does not go away—it must always be there to continue supporting a developing industry. There is also a focus on the machines in the water. There will always be a gap between those two areas, because it is not immediately obvious to outsiders that funding at pre-deployment stage is required. However, the issue screams at insiders, who know that such funding is crucial.

To a certain extent, the wave and tidal energy support scheme in Scotland was positioned around the area, but it was a smaller scheme—it certainly did not provide £30 million to £50 million. I agree fully with the IMechE's conclusions on the issue. People can argue about the exact size of the funding hole; Max Carcas can probably provide more details, based on his experience.

Max Carcas: One would need to double-check, but when I last checked in *Hansard* how much Westminster funding had been spent on wave energy devices, the total was about £7 million since 1998. That figure must be put in the context of what we are trying to achieve with marine technologies. We think that wave energy could play a substantial part in our energy mix in the future; the issue is how quickly we want to advance that.

As with anything, there needs to be investment to generate a return. Potentially, that return is not just meeting our environmental targets and our targets for supply from indigenous resources, but the generation of a great deal in the way of jobs and exports. We need only look at the investments that have been made in Germany, which employs 250,000 people in renewables. For example, I spoke to somebody who had been invited to build a solar plant in Germany and who was offered €50 million of funding to relocate from Canada to Germany to establish that plant. That indicates the priority that Germany gives to developing the energy technologies that are required.

Any funding would help to move things forward. Some good initiatives have been proposed, but translating them into action is a challenge. For example, the marine renewables deployment fund was announced in 2004, but nothing from it has been spent. The criteria for the fund were devised by AEA Technology. One must remember that the fund could provide a capital grant of 25 per cent to somebody who undertakes a project. That project must make sense economically and it must meet a set of criteria that are rather unrealistic about how a technology develops and what needs to be done.

To develop wave farm projects, all the deployment aspects must be tackled. The issue is not just converting waves into electricity—in many ways, that is straightforward—but making something that is reliable, maintainable, operable and cost effective. All those aspects must be nailed. The good news is that we are at first base on many of those aspects and that we are positioning ourselves to move forward. The machine that we are building in Leith is our next-generation machine. However, we want to secure more orders and accelerate development, whereas we are being forced to cut back on going out to secure business.

The Convener: You say that some funding streams have not been used because the criteria are wrong. Do those criteria require amendment? If so, will you tell us now or in writing how those schemes should operate?

Is up-front funding needed to assist people in getting demonstration projects into the water, or are incentives needed post success, such as—I will pick something out of the air—the saltire prize? What is the best way to ensure that projects happen?

Max Carcas: The market is the key. If we assume that what is now before Parliament is passed, that will be a tremendous step towards creating an incentive for progress. In the market, certain issues must be tackled. As I said, we have secured our first order in the UK and moved into new premises, all without any public support. We employ 75 highly qualified engineers in Edinburgh, who contribute taxes. We pay a substantial rates bill in Leith. Measures could assist us and enable us to move forward more quickly. For us, it is all about pace. We need to build on our momentum. One of the biggest killers for a company such as ours is delay, because that means having to fund ourselves to stay still. A range of initiatives could help companies. As for employment and the infrastructure, we need to build on developing a manufacturing location.

Project-specific aspects could also help. One key factor that prevents people from investing in developing projects is securing grid capacity; a long queue of projects is waiting for that. It is impossible at the moment for a marine project to progress to compete for the saltire prize, because obtaining the grid capacity that is required to deliver a project that meets the competition's criteria is impossible. Smaller projects could be undertaken, but not those of the scale that is needed to compete for the prize. The saltire prize is helpful in providing a focus to progress towards, but we need to tackle all the steps that are required to reach that stage, too. Perhaps the prize helps by highlighting what needs to be done to meet its criteria.

Lewis Macdonald: Ian Bryden mentioned the wave and tidal energy support scheme, to which about £13 million was allocated in 2006-07—correct me if I am wrong. I understand that that money is still being spent and that those projects are still proceeding. When will that money run out? Will a gap exist between the spending of that money and the award of the saltire prize in 2015? Would the money that has been put aside for that prize be better spent on a follow-up initiative to the WATES scheme that would operate when that scheme ends?

Professor Bryden: The scheme and the prize are very different entities. WATES was intended to allow the accelerated development of specific concepts, and one of the conditions was that those would be deployed at EMEC. I do not think that the saltire prize is in that part of the developmental spectrum. I understand that it is meant to be a focus and a target rather than anything else. I do not believe that the saltire prize is attempting to fill anything like the gap that we are referring to, whereas WATES was at least orientated to that part of the spectrum. I do not think that we can compare the two.

Lewis Macdonald: Does that mean that the saltire prize is not contributing to the developmental spectrum, leaving the gap unaddressed?

Professor Bryden: It is not contributing directly to that. It is a target rather than a specific funding route; I do not believe that any developers will take it into account directly in their developmental plans. The gap that we have referred to still exists and is crucial to EMEC because investment in EMEC is directly associated with that gap—it is investment at that stage of development. When the technology is in prototype form it can be tested at EMEC, but the problem lies in getting it to prototype form and then in taking it beyond that. EMEC sits in that gap as well.

Lewis Macdonald: How soon will the original prototype that was funded by WATES be ready for the next stage of support? Can we date that at this stage?

Professor Bryden: That is probably a question for Max Carcas.

Max Carcas: A range of people are developing different concepts and technologies. At the moment, certain projects have been allocated funds and others are coming forward. There is always a need to continue with the good precedent that was set by that scheme. The issue is also about how we enable as much private money as possible to enter the process. I return to my point about project development. It is best to encourage the usual suspects who would own projects—the utilities and energy companies—to move forward on that.

As I said, one of the issues is grid connection. In previous evidence, Scottish and Southern Energy mentioned the concept of connect and manage, whereby assurance that something can be done with the electricity that a project generates enables the project to move forward because there is then a basis for investment in the project that can be built on. Strictly speaking, the grid capacity might not exist at the time that that assurance is given, but it provides a clear signal to the grid operator of what will be required. Under connect and manage, compensation is paid if, for some reason, it is not possible for the grid to absorb that electricity—one must remember that the codes on that are quite conservative and that an element of constraint may be involved. That removes the whole element of risk for such projects.

Given the scale of the marine projects that will come forward over the next few years, the cost of doing something like that would be relatively small, although it would be a lot larger if it were applied across every renewable technology. Such a scheme would be well worth considering.

Lewis Macdonald: Can I press the point about the WATES funding? No doubt, you have taken advantage of some of that funding. When do you expect that funding to dry up? In other words, when will a Government decision be required on whether that good work is to be continued to the next phase?

Max Carcas: A range of people have got grants under the scheme and it depends on how quickly they are able to move forward. Some will not be able to move forward—that is the nature of the beast. A project must secure some support and then try to bring in other money, but some projects will fall by the wayside. Consideration should be given to renewing the scheme as soon as possible.

12:00

Professor Bryden: I will try to reposition WATES a little bit. If everything works according to the original plans—of course, few things do—a WATES project can and should take a developer to the point at which they can start considering the marine renewables deployment fund. If the project does that, it has successfully filled the gap. The MRDF is intended to produce not just capital funding but a contribution towards the market pool, which would start to encourage private investors to consider the options in a developer's business plan. In principle, there should be a full spectrum of projects, but the filler in the middle in this case was perhaps smaller than the gap that it was

intended to fill, and it was specific and regionally dependent.

Lewis Macdonald: That is helpful.

Christopher Harvie: I have a couple of points on the technology itself. We saw the water tank in Inverness where Wavegen, which is now part of Siemens, is testing. It was pointed out to us that it is thinking in terms of a 4MW installation for the Siadar wave energy project on Lewis. How big is the installation in Leith that you are working on?

Max Carcas: Our project in Portugal, for example, is 2.25MW and comprises three machines. That is a next-generation machine, which builds on what we have done so far and produces 0.75MW. The idea is to build 10 or 20MW projects, so we intend that machine to be the workhorse for the future. We have an order for it, whereas the Siadar project only has planning permission. The next step is to begin the process there, if the partners wish to do that.

Christopher Harvie: The manufacture of the plant?

Max Carcas: Yes. It has to be ordered.

Christopher Harvie: But there is an experiment somewhere in Iberia—in the Basque Country.

Max Carcas: That is correct.

Christopher Harvie: Engineers have pointed out to me that the great problem with anything hydraulic is seals. I do not mean the lovable, head-bobbing ones, but the seals for hydraulic transmissions. Is it right that it takes a long time to work out that problem?

Max Carcas: If I were you, I would not fly in an aeroplane because all hydraulic systems depend on the same kind of seals. We could have an engineering discussion, but the technology is well proven. Many hydraulic systems—for example, brake systems and aerospace systems—operate in the same way as ours.

Christopher Harvie: Would Pelamis have problems extracting electric connections at sea rather than on the shoreline?

Max Carcas: We are offshore because that is where the major resource is. It is a bit like considering whether to put a wind turbine in the bottom of a valley or on top of a hill. We want to be where the resource is, and the difference between offshore and the coastline can mean losing two thirds of our energy. It is also a question of where there is more space. There is a place for both offshore and coastline schemes, but it is widely recognised that, to deliver large-scale wave energy, we need to be offshore.

The Convener: Time is running short, so we will move on to Rob Gibson to talk about commercial potential and then Marilyn Livingstone to talk about the industrial base.

Rob Gibson: We have to get a good picture of the commercial potential. Mr Carcas referred to a 2.25MW project. One of the offshore wind turbines in the Beatrice project is 5MW, and commercialisation is expected on that basis. We must work out the time that it will take to develop projects for particular uses in order to assess whether they can meet the various Government targets—particularly those for 2020 and 2050. The committee needs to get a handle on how renewables will contribute their share, whether we are up to speed and what needs to be done. Will you give us some thoughts on the commercialisation phase?

Max Carcas: It is a question of what you put in versus what you get out. The Beatrice project took about £45 million of funding—our entire funding for the past 10 years—but on the back of it we are building two commercial projects and we have built five machines. You have to put any projects into perspective.

If you view where we want to get to as a war, it is not a question of whether, by 2020, we have half won the war or a quarter won the war; it is about how we win the war and do so as quickly as possible. The outcomes that can occur by a certain time very much depend on what we do right now. It is a bit like the film “Sliding Doors”, in which someone getting on, or not getting on, a tube train produces a different outcome.

Rob Gibson: I do not know the reference so that does not help.

Max Carcas: I was being slightly obtuse.

It is only 15 or 16 years ago that we had the first wind farm in the UK. The wind market has grown into a business that turns over something like €20 billion a year, with more than 100GW installed worldwide. The solar business is worth about €8 billion a year. It has a cost point higher than where we are at the moment and is supported by various Governments around the world.

When we see that growth and consider what is possible in wave energy, we think that the same opportunity exists in wave power. The resource is not a limiting factor. The technology has to be proven, it has to be right and it has to enable commercial investment, but the potential in Scotland is for several gigawatts of wave energy to be developed over time, which represents billions of pounds’ worth of investment. Our first offshore wind project in the UK, which I think was in 2003, was two machines; we are now looking at £100 billion of investment in offshore wind. In one way, the sad thing is that most of the money that is spent on the technology will be spent overseas rather than in the UK.

Rob Gibson: We heard earlier about the need for partners who want to invest their money here to exploit the technology that we have developed. One example is the Pelamis development that could lead to a wave farm off Marwick Head in Orkney. What will it take to do that from the current position? Do you need a partner to bring enough money to allow the development to commercialise to the scale of a wave farm of however many megawatts? We need to know about those commercialisation arguments. Perhaps you could tell us a bit about the process and timescale.

Max Carcas: It is everything that I have already mentioned. The company needs funding in order to continue our research and development work. Generally speaking, as a technology provider we are not a project owner: we sell our machines to energy companies and utilities, which develop the projects. For them to do that, the investment decision has to stack up and they have to be satisfied with the risks associated with the technology.

The ROCs legislation will be helpful in that respect, but funding for companies is required in order for us to support that process and to continue to deliver what our customers want. At the moment, we do not have any debt and the investment scenario is difficult—I have heard the same message from other companies in the sector. In order to accelerate development, public support would be very helpful.

Rob Gibson: We need to compare that with offshore wind, which is seen by Scottish Enterprise, HIE and so on as having great potential. The commercial development of offshore wind is aided by the current round of licences. Ian Bryden might like to answer this question: by 2020, will offshore wind provide more energy than onshore, or any other offshore technology?

Professor Bryden: That is one of those questions that are easy to ask but difficult to answer. By making different assumptions, I could probably give almost any answer.

The theoretical resource potential of offshore wind is enormously greater than the theoretical resource potential of onshore wind. With the correct legislation in place, offshore is also unlikely to be subject to the same degree of planning restrictions. However—this is an important consideration—we do not yet know what the technically available offshore resource will be in practice. Scottish waters away from the coastline are fairly deep, so we would have to consider next-generation deepwater deployment of wind turbines, such as that in the Beatrice development. Many questions will have to be answered before we know whether the technical problems can be solved economically so that we can take advantage of a wind resource that, in theory, could be enormous.

No detailed, rigorous or even defendable assessments of the wave and tidal current resource in UK or Scottish waters have yet been made. Assessments of the theoretical wave resource have been made, but such assessments are not difficult because we know how much energy is out there. I could give the committee alarmingly large figures for the ultimate theoretical resource off the west coast of Scotland, but the assessment of the technically feasible resource will require input from experienced people such as Max Carcas and other developers. I totally agree with Max that any likely development by 2020 will not be resource limited—the wind resource out there is sufficiently large that it will be a very long time before we are squeezing it.

The same goes for tidal currents. It is probably only in the past four or five years that we have had the knowledge required to understand how much energy we can take from tidal currents, so that we can look seriously at a region and say how much energy we can extract. The calculations are not, by a long way, as simple as those for wind power: some fairly hefty computational power is required—the kind of computational power that is only now becoming available. However, because of the work that has gone on over the past few years, I can say with confidence that, if you are talking only of a few gigawatts or perhaps even of 10GW and up, it will not be the resource but the funding of developments that imposes a limit. The onus will be on public funding and putting in place the market environment to enable private funding. The resource is a big issue. We know that a lot is out there, but I cannot give you a figure to the last decimal place. I would be reluctant to do so.

Marilyn Livingstone: How well developed are Scotland's industrial base and supply chain for offshore renewables? What infrastructure is needed?

Professor Bryden: That question is probably one for both Max Carcas and me. Scotland has the industrial capability: we have a long legacy of marine engineering and development, although some of it might not be in exactly the right shape to be redeployed from the oil, gas or shipbuilding industries.

Scottish universities have a substantial research and development capability. I am sure that you heard earlier about the energy technology partnership that links the Scottish universities in research into energy—a sizeable proportion of which is into marine renewables. We have a considerable legacy, which we can apply to our benefit. Some of that legacy is very recent, given that it includes our graduates from the past 10 years.

As Max Carcas mentioned, the grid is an issue. The fact that the grid cannot do what it has never before been asked to do is not the grid's fault. We have inherited a grid that was designed to take electricity from large power stations to cities and rural areas, but we are now asking it to take electricity in from the periphery. We know how to build a grid that can do that but, as others have alluded to, the issue is who will pay for it. Will it be paid for on a project-by-project basis, or will there be a big-bang investment to create a grid that takes marine renewable energy from the periphery? The financial aspects and the staged development of the grid are big issues.

12:15

Max Carcas: We have very good capabilities in Scotland. For our recent order, as with previous orders, a large part of the money that we receive will go straight through to our supply chain. I could read out a list of 15 different suppliers with whom we have placed contracts for building the project. We have a wide range of suppliers in Glasgow, Aberdeen, Edinburgh and Fife that deal with steel fabrication, paints, transformers, cranage, transport, electrical systems and hydraulic systems. All of those things are at the high-tech end of the spectrum. We have a tremendous base on which we can build—even in Portugal, we used vessels from Shetland—and if people have their R and D base and centre of manufacturing here, they are likely to use suppliers that are close by.

Marilyn Livingstone: My next question follows on from that. Do you feel that there is a need for the oil and gas industry to diversify further?

Professor Bryden: That is probably a question for representatives of the oil and gas industry rather than the marine renewables industry.

The Convener: We put it to them in our previous evidence session.

Professor Bryden: There are opportunities for companies in the oil and gas industry. The contractors have much of the skills base that will be necessary to tackle the big issues involved in the installation and maintenance of marine renewables systems—an issue that interests me intensely. Occasionally, I talk to colleagues in the major oil companies, which are keen to stress that they are energy companies. I have not yet seen a change of direction in the big petroleum companies that suggests that they are about to move quickly into marine rewewables, but I hope that discussions are going ahead. It is interesting to see that the electricity industry has made a move before the oil development industry has.

Max Carcas: There are many synergies between renewables and offshore oil and gas. If companies in the supply chain see that there is a commercial opportunity, they will be keen to be involved. For example, Neptune Deeptech in Peterhead, which has traditionally been an oil industry supplier, is keen to build on what we are doing. Further down the line, there is the potential for synergies between power generation offshore and enhanced oil recovery. Given the need for energy offshore, there could be some interesting developments over time.

The Convener: Rob Gibson has a very brief question on port facilities.

Rob Gibson: It is important at this stage to ensure that the infrastructure is in place—that lesson was learned in setting up the oil industry, which required jackets for offshore rigs and so on. Are the port facilities currently available in the areas where there will be work? I am thinking about Scrabster and the potential for projects in the Pentland Firth. Ports are multipurpose but, if they are to support renewables, they need to be funded.

Max Carcas: I agree. We need fairly modest facilities, but we must have access to them. In Orkney, we have used an unused pier at Lyness, the formal naval base. It is a very rudimentary set-up and, if things develop, an awful lot of investment in facilities will be required.

Rob Gibson: So they should be being planned and developed now.

Max Carcas: Yes.

Lewis Macdonald: We are about to hear from the minister on renewables obligation certificates, which have a clear relevance to your sector. If you were to say one short thing to the minister about ROCs, what would it be?

Max Carcas: Go for it.

Professor Bryden: I fully agree.

Max Carcas: To put it in context, I think that I read in the draft Executive note on the subordinate legislation that the cost to the Scottish consumer of implementing the scheme will be less than 0.1 per cent of a typical Scottish household's energy bill. It is an important step, but if we want to reach our targets we must accelerate what is being done on a number of fronts.

The Convener: Thank you for your evidence, which has been very helpful to our inquiry. We look forward to visiting EMEC in a couple of weeks and the CCS Schwarze Pumpe plant in Germany at the end of April.

12:21

Meeting suspended.

12:25

On resuming—

Subordinate Legislation

Renewables Obligation (Scotland) Order 2009 (Draft)

The Convener: I am conscious of the fact that we are running a little over schedule today, but we had a very interesting evidence session as part of our energy inquiry. I am sure that the minister will read the *Official Report* of that later.

Item 4 is evidence on the draft Renewables Obligation (Scotland) Order 2009. I ask the minister to make some opening remarks, after which we will ask questions. I remind the minister that he is not moving the motion at this stage; we are taking evidence before we move on to that.

The Minister for Enterprise, Energy and Tourism (Jim Mather): I am happy to be here to speak about our proposed introduction of a new and revised renewables obligation (Scotland) order.

Members will be familiar with and will understand the importance of the obligation both to renewables in Scotland and to the ambitious targets that have been set, around which there is a material degree of consensus. The obligation mechanism has been in place since April 2002. Renewables generation in Scotland now accounts for more than 20 per cent of gross Scottish demand, up from 12 per cent in the obligation's first year. By any definition, the obligation has been a success, but it needs to evolve to help us to meet the new and more challenging targets that have been set by the European Union and welcomed by the Government.

The draft order rewrites important elements of the original mechanism. The changes, which are also being introduced to the obligations in England and Wales and in Northern Ireland, deliver the concept of banding. Put simply, banding dismantles the previous, technology-neutral approach. It enables the provision of higher levels of support to different renewables technologies depending on their cost and maturity. Until now, each unit of eligible renewables output has qualified for one renewables obligation certificate. Under the banded obligation, offshore wind, biomass and solar generation will receive more ROCs than onshore wind and hydro, which will, in turn, receive more than landfill or sewage gas. The model has strong echoes of the changes that were introduced to the Scottish obligation two years ago, which offered higher returns for wave and tidal generation.

I stress the Scottish Government's intention to maintain its higher level of support for wave and tidal power under a banded obligation relative to the rest of the United Kingdom. We notified the European Commission's state aid officials of our intention to do that—subject to the outcome of our consultation—before Christmas. Unfortunately, we did not receive the Commission's formal approval before the time came to lay the order before Parliament, but we expect to receive that permission shortly. Consequently, I intend to lodge a minor amendment to the order, at the earliest possible opportunity, to introduce the enhanced bands for wave and tidal generation in Scottish waters, which we have consulted on and agreed.

There are several other distinctive aspects of the new obligation. Central to those is the proposal that the obligation on energy suppliers will now be to submit a certain number of ROCs. That means changes to the way in which a supplier's obligation is to be calculated, which are set out in part two of the order. There are also important provisions in part 6 to protect the position of generators who invested on the basis of the previous obligation.

In addition, article 33 of the order gives the Scottish ministers the power to review the banding provisions at four-yearly intervals. The first review is due to commence in October 2010, but a review may occur at any other time if any of the circumstances that are set out in article 33(3) arise. The circumstances that could trigger such a review include significant changes to the grid charging regime and evidence of substantial reductions or increases in technology costs.

The order is an extremely important piece of legislation that consolidates the momentum that has built up around renewables generation in Scotland. It seeks to replicate that success with the emerging technologies in which Scotland has a huge potential for deployment, and I believe that it merits the committee's support and agreement. Before I formally move the motion to recommend the order, my officials and I will be happy to respond to any questions that the committee has.

12:30

The Convener: Thank you for those opening remarks, minister. I will ask the first questions to get the ball rolling. What are the differences between the proposed Scottish scheme and the scheme that will operate in the rest of the UK? What are the financial implications of those differences, if any, for the Scottish Government and companies that operate in Scotland?

Jim Mather: The differences are essentially to do with wave and tidal energy. We are talking about five ROCs for enhanced wave generation and three ROCs for enhanced tidal generation.

That element is subject to approval by the European Commission, but the early signals are extremely positive, and I believe that that approval will come through.

The cost implications are spread throughout the UK because ROCs are patently tradeable. Our understanding is that, even if the level of 80MW is reached in the next cycle, the cost implications will be something like 40p per household. I think that I am correct in saying that the costs would be neutral for the Scottish Government.

Neal Rafferty (Scottish Government Business, Enterprise and Energy Directorate): Yes. That is the case for the wave and tidal measure, depending on its success. For the obligation as a whole, it has been forecast that banding will lead to higher costs of the order of around £1.7 billion across the UK, but more renewable generation will be delivered for that money.

Jim Mather: The £1.7 billion is the sum to 2027. I have calculated that the cost will be £1.50 per person per annum.

The Convener: For the record, what will the equivalent ROCs be for wave and tidal energy in England and Wales under their proposed scheme?

Neal Rafferty: There will be two ROCs for wave and tidal energy in England and Wales.

Lewis Macdonald: It has been said that the cost implications are UK-wide or Great Britain-wide. Does that imply that the Department of Energy and Climate Change as the relevant UK ministry fully agrees with the enhancement?

Jim Mather: That is my understanding. We are playing to Scotland's strengths, which can contribute to meeting the wider climate change and renewables targets.

Lewis Macdonald: Will the provision in article 33 to allow ministerial review change in any way the relationship between reviews by the Scottish ministers and those by UK ministers with reference to the rest of the UK?

Jim Mather: We will do things in sync, as we have done all the way through. Essentially, we are playing to our strengths—the strengths are relatively different in the two jurisdictions—to work towards common UK as well as European goals. We have been very successful of late in drawing the attention of Commissioner Piebalgs and Georg Adamowitsch, who is the EU's North Sea grid co-ordinator, to Scotland's significance and potential, and we are committed to working in harmonious sync as well as we can.

Lewis Macdonald: It is clear that there is a distinction between playing to one's strengths to reach common, shared policy objectives and setting off on a different policy direction. From what you say, it seems that the first approach, and not the second, is being considered.

Jim Mather: That is correct.

Lewis Macdonald: Article 3 proposes changes that relate to energy from waste. What difference will the new arrangements make to the Scottish Government's support for generating energy from waste?

Neal Rafferty: I hope that I can clarify what those proposals are intended to do.

The proposals will apply across the UK, so we will be absolutely in step with what DECC proposes to do in England and Wales. The reason for the changes in article 3 is that, according to the energy-from-waste sector, it has been extremely difficult for it demonstrably and accurately to measure the renewable content of a mixed waste stream. The proposals will enable energy-from-waste generators to claim to the Office of Gas and Electricity Markets that 50 per cent of their fuel mix is from renewable sources. That is a very conservative estimate—the evidence base suggests that the figure will be higher than that.

Energy-from-waste generators will therefore be allowed to claim that up to 50 per cent of their fuel mix is from renewable sources by providing evidence short of waste mixture sampling. If they want to claim a higher percentage, they will have to provide much more accurate and painstaking evidence. The idea is to make the process a little more straightforward for people to manage and for Ofgem to administer.

Lewis Macdonald: That is helpful. Thank you.

Gavin Brown: The Scottish Government's Executive note says that the additional cost on domestic households' annual bills will be £11.41. What will be the annual cost of the order to businesses in Scotland?

Jim Mather: I am not sure that we have drilled down to identify the specific impact on businesses.

Neal Rafferty: We simply do not know. Suppliers are at liberty to pass on costs incurred through the obligation to their consumer base however they see fit. Ofgem has calculated that the obligation will add £11.41 to a domestic consumer's bill, but it is entirely up to suppliers how that load is shared among domestic consumers, small businesses and large consumers. As I say, we do not have a figure, but I do not think that it will be demonstrably different from the figure for domestic households. Indeed, it might even be less.

Gavin Brown: According to the regulatory review group that was set up on the minister's

watch and which reported well over a year ago, business impact assessments are vital to any Government legislation. Am I right in thinking that such an assessment has not been carried out for the draft order?

Jim Mather: It has not been carried out at this stage, but I can say that the regulatory review group and the business impact assessments that it has recommended are very much work in progress. Indeed, in order to get the debate on the practicalities properly under way, we held a session at Victoria Quay yesterday under the auspices of the regulatory review group not only with regulators such as the Scottish Environment Protection Agency, Scottish Water, Scottish Natural Heritage and the Scottish Commission for the Regulation of Care but with business organisations.

Gavin Brown: I accept that it is work in progress but, as I pointed out, the group reported a year ago and made what seems a fairly simple, intelligent and appropriate recommendation. Will the minister undertake to ensure that, when he appears before the committee with any piece of legislation, he has made every effort to carry out a business impact assessment on it?

Jim Mather: Absolutely. That is certainly our direction of travel, and I am happy to report that yesterday's productive meeting between the regulatory review group and the regulators has led to a flurry of practical measures that everyone can engage with to take this work on to the next level. We had 60 of the various regulators and regulated in the room, and they all picked up on the business impact assessment as something that sends out the right signals and creates the right movement towards increased sustainable growth. We will do everything practical to achieve that end.

Rob Gibson: Returning to an earlier point, I presume that the Department for Business, Enterprise and Regulatory Reform has given you the go-ahead to enhance offshore energy development, given that such acceleration benefits the UK hugely in meeting its EU targets.

Jim Mather: Absolutely. We are finding that there is a common purpose and are working well together on examining the potential of offshore wind power in the short to medium term.

The Convener: We now move to the formal consideration of the motion to approve the draft order.

Motion moved,

That the Economy, Energy and Tourism Committee recommends that the draft Renewables Obligation (Scotland) Order (SSI 2009/draft) be approved.—[*Jim Mather.*]

Motion agreed to.

The Convener: I thank the minister and his team for their evidence.

It remains for me to seek the committee's agreement to prepare for Parliament a short factual report on our discussion and decision.

Members *indicated agreement*.

12:39

Meeting continued in private until 12:55.

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