



Welsh Affairs Committee

Oral evidence: [Energy generation in Wales: Shale gas](#), HC 731

22 October 2013

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Written evidence from witnesses:

- [Professor Hywel Thomas](#)
- [Professor Richard Davies](#)
- [Professor Kevin Anderson](#)
- [Natural Resources Wales](#)
- [Friends of the Earth Cymru](#)
- [WWF-UK](#)

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Members present: David T.C. Davies (Chair); Geraint Davies; Glyn Davies; Stephen Doughty; Jonathan Edwards; Nia Griffith; Simon Hart; Jessica Morden; Mr Mark Williams

Questions 1–103

Witnesses: **Professor Hywel Thomas**, Royal Society and Royal Academy of Engineering (Cardiff University), **Professor Richard Davies**, Durham University, and **Professor Kevin Anderson**, Deputy Director, Tyndall Centre for Climate Change Research, Manchester, gave evidence.

Q1 Chair: Good morning. Thank you very much for coming along this morning; we appreciate it. I will start by asking how important gas will be for the UK's energy mix over the coming years.

Professor Anderson: You have to say in what context you want to ask that question. If it is in the context of climate change, to which most of my work relates, gas cannot play a very significant part in our energy system going forward, even if you take the DECC or the CCC view on this, because it is a very high-carbon fuel—it is 75% carbon.

Q2 Chair: But gas is much lower carbon than coal, isn't it?

Professor Anderson: It is 75% carbon, so it is a high-carbon energy source. When you burn gas, you get carbon dioxide. We know what carbon budgets we have both

domestically and internationally, so you can do the basic maths on that. If you are serious about climate change, gas cannot be a large part of your future. If you are not serious about climate change, gas can be a very significant part of the—

Q3 Chair: Are you a supporter of nuclear energy?

Professor Anderson: I am agnostic. We wrote a report on it recently, and I remain agnostic about nuclear power. It is a very low-carbon source of energy—much lower than gas. Even gas—

Q4 Chair: Would you prefer nuclear power stations to gas power stations?

Professor Anderson: If I had the choice, in terms of climate change, without a doubt. You have to set the context every time. If it is for climate change reasons, nuclear has about a 10th of the emissions of gas, with carbon capture and storage.

Professor Thomas: I am not an expert on economics, the supply chain and so on, but my understanding is that we are committed to gas for 30 years. The real issue is how we work out the transition and get to a future beyond that. In terms of the shale gas agenda, it is a question of where we might get our gas from, rather than whether we will have gas for the next 30 years. I understand that that is Westminster Government policy.

Professor Davies: My answer to the question is that the estimates of the amount of gas that is available are quite considerable. You really need to ask how many wells you are willing to drill. We know that the amount of ultimate recovery from a gas well in the United States is anywhere between 1.4 billion cubic feet and 5.9 billion cubic feet. That sounds like a large number, but it is actually a very small number, so you need a lot of wells to produce an amount of gas equivalent to what you would have got from the North sea, for example. The question—to turn it around—is, how many wells can you drill economically or with social acceptability? If you drill thousands, you will produce reasonable volumes of gas.

Q5 Chair: It may be quite hard for you to give me this kind of figure, but so that we can compare apples with apples, is it possible to say how much energy one frack-pad could produce compared with one large wind turbine?

Professor Davies: I do not have those sorts of statistics.

Q6 Chair: Does anyone have them? I have been trying to find this out and it has been quite hard.

Professor Davies: There is probably a significant range of answers to that question, depending on where the wind turbine is and where the shale gas well is. What I will say is that our statistics from the southern North sea, from where you get conventional gas, show that those wells produce tens of times more gas than a shale gas well. You therefore need to drill a lot of wells. One of the questions this Committee may ask is, how much gas is there? I would say, how many wells do you want to drill?

Q7 Nia Griffith: You have given us some figures. Can you give us a rough idea of how that compares with the North sea? When you say thousands, are you suggesting that you need a certain number even to make it viable—even to consider doing it? People are looking at ones and twos now. If you are talking about hundreds or thousands, presumably you are saying that you need to start with 20 or 30 even to get off the starting blocks. Can you give us a bit

of an idea, because honestly I do not think that most of us know how many tunnels will be required?

Professor Thomas: That is the \$64,000 question. Frankly, I do not think anyone knows. At the moment, you have estimates from the BGS for the gas reserve in the Bowland. That is one of the UK's shale reserves—obviously, it does not cover Wales at all—but they are estimates with a capital E. That is exactly what the BGS would say. They are very dependent on the thickness of the strata that have been selected. I am not saying that the estimates are wrong, but there is a difference between estimates and what we know, and a difference again, when you do know, between the reserves and what is exploitable. So that is absolutely the \$64,000 question. In terms of taking everything forward, I would also set the context that we need to look at this in the two phases that would normally apply for gas exploitation—an exploration phase followed by an operational phase.

Professor Davies: The key word is “resource”. The numbers that are being used are for resources—theoretical volumes of gas under the ground. The number for northern England is 1,329 trillion cubic feet of resource. If 10% were recovered, that would be 133 trillion cubic feet. That outstrips the North sea's supply of gas since it started, which is around 88 trillion cubic feet. These are vast numbers, but to produce 10% of 1,329 trillion cubic feet may require tens of thousands of wells.

Q8 Nia Griffith: Tens of thousands of wells? So we are not even talking about just 1,000 wells.

Professor Davies: That is right. We are making an assumption that US wells are a good indicator of what UK wells would do, but if the US analogy works, I come back to what I said a few minutes ago—you really have to ask yourself how many wells are economic and can be drilled in the social environment we are in.

Q9 Simon Hart: Can you describe what a well consists of?

Professor Davies: When it is being drilled, a well is a derrick tens of metres high. Eventually—for 10 years—you will have a wellhead that is 2 or 3 metres high and will be difficult to spot. It will sit on a well-pad the size of a cricket pitch.

Professor Anderson: But you would have to refracture fairly regularly on some of these wells.

Professor Davies: If the economics were right, you could go back and refracture, yes.

Professor Anderson: I want to come back to the point about trying to find some overall scale for this. Unfortunately, I tend to work in cubic metres, whereas Professor Davies talked about cubic feet. Just to give you some handle on it, at the moment the UK consumes roughly 100 billion cubic metres of gas. Very approximately half of that comes from the North sea, a quarter from Qatar and a quarter from Norway. The BGS middle estimate for the Bowland shale reserve is about 38,000 billion cubic metres.

Q10 Chair: So 100 billion cubic metres a year is what we use at the moment.

Professor Anderson: Yes—100 billion cubic metres is what we use at the moment. BGS's mid-estimate, I think, for the Bowland shale is that there is 38,000 billion cubic metres of gas there. However, as Professor Davies quite rightly pointed out, even if that is correct, you cannot get all of it out. If you could get just 10% of it out, that is the equivalent of 38 years of our current gas consumption. That is from one resource—the Bowland shale

resource. The BGS mid-estimate is that there are 38 years of current gas consumption in that one alone.

One other number I would add to that is that, if there were that amount of gas and you took out and burned 10% of it, it would pretty much wipe out the whole of the UK Government's carbon budget between now and 2050.

Q11 Chair: I know Stephen wants to get in, but can I ask you one thing? How many wind turbines would we need to build over the next 30 years to meet our carbon emission targets?

Professor Anderson: I am sorry about the detail of this, but we have two sets of carbon emission targets—the ones we sign up to internationally and the ones we sign up to domestically. Those are completely different, so you would have to tell me which ones you were talking about. Our international commitments—

Q12 Chair: Can you give me a rough figure for both?

Professor Anderson: You are talking not just about electricity but about the whole energy system—providing fuel for planes—

Q13 Chair: Roughly how many would you like to see us build?

Professor Anderson: I would like to see us go much further offshore with some of them—the much bigger ones, at 7 MW. We would be talking about tens of thousands of those, but that would not be enough. It would be inappropriate to suggest that you could use just wind to provide all of the UK's energy needs.

Q14 Stephen Doughty: Do you have very specific figures for Wales for potential reserves and their potential value? We have heard some quite strident figures of something like £70 billion of reserves being available. Personally, I am quite sceptical about such figures, given the uncertainty that all of you have described. What do you make of those types of claims about value and availability of resources in Wales?

Professor Thomas: I would genuinely like just to keep stressing that these are estimates—they really are. One borehole has been drilled in the UK so far to give us an idea of how much gas is there—one. Tens of thousands have been drilled in the US. There are big dangers in comparing and tracking across. That is not to diminish the possibility, but these are what they are—they are estimates. The Welsh Government have just issued a small contract to BGS to try to get the first handle on demand and reserves in Wales, but these are not cheap figures to come across—you need people out there drilling holes.

Q15 Stephen Doughty: So currently there are no accurate figures specifically for Wales—either for money or for the amount of reserves.

Professor Thomas: Even those for the Bowland are estimates. I stress once again—as many times as I possibly can without all of you getting fed up with me—that these are estimates. There are dangers in thinking that they are absolutely accurate—they are not.

Q16 Stephen Doughty: The other day, it was suggested to me by an expert in the field that because of all these factors we would not see these resources in Wales exploited in his lifetime—for the next 30 or 40 years.

Professor Thomas: Again, I think it would be really useful to set the whole context in the normal way in which these extractive industries work. They do not just dive straight in—there has to be an exploration phase first. As you proceed into the exploration phase, you get a better idea of what is below ground. This stuff is 2 km below ground. To know what is actually there, you need to be down there to take samples and to bring them back to the

lab and test them. You will get a good indication from the geology, and the geology of Wales is quite rich, in one sense, for potential shale gas; I am sure that Richard can comment on that. However, you still have to define how much organic content there is and how suitable the shale itself is. I do not think that work has been done for Wales yet.

Q17 Stephen Doughty: Can we try to get a practical idea of it? As you are probably aware, some licences have been granted for exploration in the Vale of Glamorgan, which part of my constituency covers. I do not know how much you know about it, but how many frack-pads would you need on a site such as that to exploit the resource that is potentially under there? Can you give us even a finger in the wind?

Professor Thomas: You know that it is possible to drill horizontally these days—that is really part of the key to the whole shale gas development. The world record for drilling horizontally these days is 10 miles or something like that—it is really quite substantial. Obviously, that adds to the cost of the whole thing, but I suspect that one of the key issues when it comes to looking at the exploitation phase will be the trade-off on the economic side with regard to how far people need to drill horizontally. I know the discussion in the Blackpool area at the moment is precisely about how closely spaced the pads will be. The technology will allow you to drill horizontally and frack, so theoretically you can have the pads quite a distance apart, but obviously that adds to the expense. Again, those are all still in the unknown category.

Professor Davies: I just wanted to add that you can drill perhaps 10 to 12 wells from one pad—and then multilaterals. Where you have a thick shale such as the Bowland, you can think of doing it in multiple layers, like a multi-storey car park. In the US, it is multilaterals in one layer—a thin layer. In the Bowland, they are thinking of doing it in multiple layers. That may decrease the spatial extent of the exploration and production activity because you have thick shale in one place. Each well may produce around 2 billion cubic feet of gas—

Q18 Chair: Each well may produce 2 billion cubic feet?

Professor Davies: Something like that. The range I gave earlier was 1.4 to 5.9, but let us just use 2 as a simple—

Q19 Chair: Can we do it in metres?

Professor Davies: I cannot convert to metres on the spot, I am afraid. I am sorry—the industry uses billion cubic feet a lot. We think from the States that each well produces 2. You would have 12 wells on one pad, perhaps, each producing that sort of volume of gas in its lifetime.

Q20 Chair: So you would get 24 billion cubic feet from one well.

Professor Davies: From one well-pad, potentially—if we can use the US as an analogue.

Q21 Chair: Earlier someone said that we use 100 billion cubic metres a year, so that is potentially one well supplying a quarter of our gas needs.

Professor Davies: No, it is not. I have done a quick calculation; I am sorry, but I am going to use different units. We import 50% of the total gas that we use. Basically, you would need hundreds of wells—probably in excess of 700—to produce every year half of our gas use in the UK.

Q22 Stephen Doughty: Just to nail this on the head, when people talk about us exploiting these resources in the way that has been done in the US and this being a revolution—big terms like that—essentially, we are talking about an extremely different context here in terms of geology, space, potential implications and the ability to exploit on the same level as the US, Australia and places like that.

Professor Davies: Yes—and we will need a lot of wells. That is why I keep reversing the question. If you say, “How much will we get?”, I will say, “How many wells do you want to drill?”

Q23 Geraint Davies: Just so that we are clear about it, the 700 wells would be only seven pads. You just said that 700 wells could supply half of our gas needs.

Professor Davies: No. Based on the US analogy, for 1 trillion cubic feet you require between 169 and 714 wells. We use 3.6 trillion cubic feet a year.

Q24 Geraint Davies: I was coming from the fact that Swansea Bay city region is on the shortlist to be the UK city of culture 2017. One of the issues people are interested in is, if we suddenly fully exploit shale gas, what will Swansea Bay city region look like as a tourist and cultural destination? Will it be a pockmarked landscape? What are we talking about?

Professor Davies: That is a very difficult question to answer. What I will say is that a well-pad can have quite a small visual imprint—it could be difficult to see. We have 2,150 wells in the UK already. I doubt many people have seen them, so a well-pad can have a small visual imprint. Obviously, if you need thousands of wells—which is the sort of thing we are talking about—that will have an imprint. As I said earlier, a well-pad would occupy approximately the same space as a cricket pitch. Based on the US statistics for gas productivity, you may need hundreds, possibly, or more—a thousand-plus well-pads—to produce a significant volume of gas.

Q25 Geraint Davies: Before Professor Thomas comes in, can I widen the question to Wales as a whole? Wales is a sparsely populated, very beautiful country at a time when globally we are seeing a massive increase in the amount of tourism coming out of China, India and the BRIC countries, so the economic opportunity for Wales is absolutely immense in terms of our natural environment. How much of a threat are all of these cricket-pitch size fracking-pads, if fully exploited, to Wales’s economic opportunity in tourism?

Professor Davies: That is completely outside my sphere of expertise. I will give you some context. There are 250,000 abandoned coal-mine shafts in the UK, and we do not know where they are. We do have a history of coal mining, which gives you some idea of the legacy of a very significant fossil fuels industry, but I do not know. That is completely outside my area of expertise, so I am afraid I cannot answer the question.

Q26 Geraint Davies: Does Professor Thomas want to come in on this?

Professor Thomas: I would find it hard to relate to the vision of a sort of moonscape.

Q27 Geraint Davies: An aerial view of pockmarked Wales.

Professor Thomas: I have probably seen the diagram depictions that you have seen. I find it hard to imagine that Wales would look like that. There is one excellent example of best practice. I am not really here just to defend that, but there is a drilling farm in Dorset called Wytech Farm, which has been in operation and producing for quite a long time. I suspect that most of us do not even know it is there, and that if you went to Dorset you would not know it was there. Again, it is not for me to say, because it would require everything that we have recommended in our report—good regulation and best practice—

in developing wells. I would just say that right here in the UK today there is an example that is working.

Chair: Thank you. I had better move this on a little bit. Professor Anderson can come back in a minute.

Q28 Simon Hart: I think it is another hypothetical question that you probably will not be able to answer. It follows on from Stephen Doughty's reference to the Vale of Glamorgan. Assuming that an investor could get over the regulatory hurdles that would be in their way and that it was viable to frack in the Vale, have you made any assessment of what the economic benefits—not the economic downsides or the impact on tourism—might be for people who might derive employment from the project and, consequential to that, what the positive impact on manufacturing industry in Wales might be? Has anybody been able to hypothesise, based on a very conservative estimate of what might be possible?

Professor Thomas: Personally, I am not aware of anyone having done that sort of study. The fact that so little is known about the volume of gas that is potentially in Wales is probably holding people back, but I cannot believe that that cannot be done. I know that studies like that are done for other areas, so I think it is perfectly feasible, but I do not know of anyone having done it.

Professor Anderson: To put it in some context, are you talking about local jobs? Previously, I worked for 10 years in the petrochem industry. I worked in north Wales as one of the commissioning engineers for the Point of Ayr gas terminal, which feeds Connah's Quay power station. Most of the people who worked there were not from Wales. They were brought in, as they normally are for very large petrochem projects, from other parts of the UK—principally Scotland and the north-east, going by the accents. We did use some local employment for setting the foundations—the groundwork—but above ground most of the people came in for a one or two-year stint and then went back or went to another project elsewhere. I do not know how that would play out, but when you ask the employment question, you need to ask it in the context of the local skill set that is actually there and to ask whether or not the industries that would be doing it would use that local skill set.

Q29 Simon Hart: There would be a construction phase, presumably, which would have a measurable impact. The people who might then be responsible for running the installation might not necessarily originate locally, but they might live locally and therefore have some positive effect on the locality. Professor Davies mentioned that there were 2,150 existing wells, so there must be some employment comparison that already exists in the UK for the number of people who are currently employed in the sector. Do we know how many that is?

Professor Davies: I do not have statistics on that. We have drilled 2,152 wells since 1902, so 19 a year on average. For the next four or five years—because, as Professor Thomas pointed out, the UK is in an exploration phase—I would not expect more than the same sort of number of wells to be drilled. I doubt very much at all will happen for the next four or five years. Unlike the United States, which had rigs in Texas that could be refitted and moved to Pennsylvania and so on, we simply do not have the supply chain for a huge industry right now. It is the exploration phase—half a dozen wells a year. That sort of number is more realistic.

Chair: I want to make sure everyone gets a chance, so can I bring in Nia next? I will come back to Geraint in a minute.

Q30 Nia Griffith: One discussion that arises time and time again, of course, is that the population is exactly where the coalfield is. When we look at things such as the earthquake frack—we know we are talking about tremors, not tsunamis—we also know villages that have been blighted by subsidence and so forth. It is exactly those areas that will have the fracking, so how much do you see that sort of issue being a problem? Obviously, we are aware of what happened in 2011, with the seismic movements up in the north-west. To what extent is that a real problem?

Professor Thomas: I do not think there is any evidence to show that it is a big problem. I refer back to the report group of which I was a member. We looked very closely at that; it was one of the terms of reference of our report. At Blackpool, it seems that the fracturing process intersected with a fault that was already in the ground. In the main, you will not really feel anything. These are things that are happening 2 km below ground. “Earthquake” does not seem to be the appropriate word to use—these are tremors. You are unlikely to feel the majority of them. However, the report advocates a traffic-light system for any excessive movement that comes about. Again, the key to it all is to make sure that regulations are in place so that these things are managed according to a traffic-light system.

Q31 Nia Griffith: I accept that we are not talking about major earthquakes, but we do know that subsidence has long blighted our communities in south Wales.

Professor Thomas: Yes, but with coal mining you are taking out up to half a metre of space. A void is created there. These are fractures in the shale itself—there is a borehole and fractures. There just isn’t the void displacement to cause that sort of subsidence.

Professor Anderson: BGS, which is an independent company that is looking at this, thinks that the seismic problem is very small indeed. If we take the ones you saw around Blackpool, there are 60 or so of those per year naturally, and they are incredibly small. From my reading of BGS’s outputs on this, its view is that seismic concerns are very much exaggerated in the press.

Leading on from the point that you made about where people are living, I think the other point we have not dealt with—this goes back to one of the earlier points—is the traffic implications. While the well itself might be like Wytch Farm—Wytch Farm does not have to be refractured quite regularly—you may have to go back on a significant number of occasions to refracture some of the wells. That would involve a lot of traffic. While the site can be dealt with by a clever bund around it that is grassed and so forth—that is what they do at Wytch Farm—the traffic side is an element that has not been appropriately addressed. Of course, there are no parallels with the States, because very few people live in those areas. If you are looking at these issues, you have to put all the bits together and then make your judgment.

Professor Davies: What my colleagues have said is very important. At Durham, we have researched some of these classic risks. On contamination of water, I am afraid there is no evidence to support the claim that fracking itself—the cracking of rock—contaminates water. Spilling chemicals or leaking wells—coming back to the well issue—can contaminate water. Earthquakes can occur. The biggest event that has happened was 3.8; it happened in Canada in 2011. However, we have only three places where felt seismicity has happened, after hundreds of thousands of fracking operations. So it is a small risk, but it is there.

As Kevin said, in the UK we need to focus on the really big risks—the things that people see. There is no doubt that there would be increased road traffic, which would cause a nuisance—and worse. We need to re-address the conversation to what are clearly the important risks.

Q32 Jonathan Edwards: What would be the benefit to the Welsh Exchequer of the exploration and extraction of Welsh shale sources?

Professor Thomas: Jobs would be created. You represent Wales; I live in Wales. I do not need to tell you that energy is not an insignificant issue. In south Wales, we have major employers that are huge consumers of energy. In the world where I live, I often hear about the energy demands of those large employers. If there is a local supplier of gas that is connected to those big energy users, there is a dynamic that might work well. However, I am not an economics expert; somebody would need to study that.

Q33 Jonathan Edwards: Can I frame it in another way? In your view, if you have a view, who should have the proceeds of Welsh exploration and exploitation of Welsh shale resources—the UK Government or the Welsh Government?

Professor Thomas: Can I pass on that?

Professor Anderson: If I were Welsh, I would say the Welsh Government, but I will not make comment on that. On the employment side, you have to think that any investment brings with it employment. If you have a certain amount of money that you need to spend on energy and you spend it on fracking operations and shale gas, clearly you cannot spend that same amount of money on wind turbines or a Swansea bay tidal barrage scheme. You will have employment from whatever form of energy you generate. When we look at these issues, you cannot just assume, “Here is this employment that comes with wind turbines, shale gas or whatever else.” You have to look at the portfolio of opportunities that are there, how much money you have to spend—

Q34 Chair: But isn’t there a difference, Professor Anderson? Wind farms require a subsidy, which requires taxation, and taxation means less money for those who are taxed, which means less investment. Jobs cannot be created through subsidies, whereas those who want to frack are saying absolutely, “We don’t want any money. All we want is the permission to go ahead.”

Professor Anderson: You may well be right about that, but you would need to have a chat with the Chancellor. He has given tax breaks to shale gas exploration, so the subsidy is happening for shale gas.

Q35 Chair: Isn’t he simply saying, “I will tax you at only 30% while this gets up and running”? Thirty per cent of a lot of money is better than not having anything at all.

Professor Anderson: Talk to National Grid about the onshore wind turbines. Those virtually do not need a subsidy now because the structure is actually in place—we are still using it. The onshore wind turbines, which are much cheaper to build than offshore wind turbines but have a lower output—a lower capacity factor—are now pretty much comparable with a lot of the generation that is on the grid, so I think we have to be careful about how we do the subsidies.

We also have to be careful about what other subsidies are going into these things. I drive a diesel car. Someone has to pay for asthma inhalers because of the particulates that come out of diesel. We are always paying subsidies, in one way or another. The subsidy

argument is often polarised, rather than people standing back and looking at the array of issues you have to take account of.

Q36 Chair: Professor Davies, do you want to come in on that?

Professor Davies: No, I have nothing to add on that. My colleagues have done a good job.

Q37 Geraint Davies: Obviously energy bills are very much at the top of the political agenda in terms of the cost of living crisis. Does anybody have particular views on how energy bills would reduce if fracking were fully exploited? Would it reduce the price of gas, or would that not happen?

Professor Anderson: I think it is fair to say—there may be one or two other exceptions to this—that the only person who has come out and said that bills and the price of gas would come down significantly with shale gas is our Prime Minister. The Committee on Climate Change does not agree with that. The DECC report that has come out did not agree with that. It will be part of the European gas network. It may make some very small marginal change to the price of gas within that European gas network, but there is no suggestion that shale gas will significantly reduce energy bills in the UK, because we are part of a gas network.

Q38 Chair: Professor Davies, some people would think that the basic rules of supply and demand are that if you introduce a large quantity of something the price falls. Is that not the case with shale gas?

Professor Davies: I am afraid that, again, I will have to stick to my area of expertise, which is the geoscience and engineering element. I am not an expert on economics; I think Kevin has more of a background in that. It is not an area I can cover.

Professor Anderson: No one—other than the Prime Minister, I think—is suggesting that you would see a significant reduction in the price of gas because we are part of the European gas network, which is partly influenced, of course, by things like the Russian gas supply. The Russian gas supply is also very large, so we would be adding to an already very large gas network.

Q39 Chair: But in the US gas prices have fallen to about a third of the level that they are here, haven't they?

Professor Anderson: But they are not part of the European gas network. They fell partly because of the tight oil that came with it. Part of the fall in the States is because of the price of the gas, but they are not tied into the European gas network. I suppose you could untie us from the European gas network and the price structures that are there. You could do that, although that would be quite challenging in itself—and risky. If you are prepared to do that, you may be able to make parallels with the States, but you cannot make parallels when we are part of the European gas network. I do not think any economist is coming out and saying at the moment that we would see prices come down because of shale gas.

Professor Davies: The other point I wanted to add is that, for any of this to make a material difference to the UK so that the gas price can change a little bit, there will need to be a lot of wells, and those wells will need to be checked. I am not sure the regulatory system is absolutely razor sharp in terms of well checking. I am basing that on our historical track record on that.

Professor Thomas: Do you mind if I follow up on the well issue? We as a group were asked to look at two issues: seismicity, the one that you raised, and groundwater contamination. Those were obviously the headline issues everybody was worrying about. Our report addresses those issues and concludes that, frankly, the risks are relatively low, although that is not to dismiss them.

The area our group was most concerned about was the drilling of the wells and so-called well integrity. It is not rocket science, really, but if you drill a hole in the ground down 2 km to where the shale is, you will create a short circuit. If it is not properly constructed and sealed, that could lead to contamination and things like that. The whole issue of well integrity was placed right at the forefront of concerns, in our report.

A lot of work has been done since then. We advocated that there should be an environmental as well as a regulatory look at it. Through their new office, the Government are addressing those issues. There have been statements recently about the Environment Agency and the Health and Safety Executive working together more closely.

Our group felt—this picks up some of the worries that Richard mentioned—that there should be an independent examination of all of these issues on site. I think it is fair to say that we are still working towards that final agenda. I would like continually to repeat that risk escalation is needed here, because there is still only one hole that has been drilled in the UK—just one—compared with 10,000 in the US. Comparisons with the US do not hold water at all. The market is completely different. It is really difficult to say what—

Chair: I suppose we will not know until we drill some more holes.

Q40 Mr Williams: What are the US experiences of the risk of contamination?

Professor Thomas: I am sure you have all seen the “Gasland” video. It seems likely that that is just a manifestation of the very worst practices—

Q41 Chair: Is it the case that that has been comprehensively disproved?

Professor Thomas: Yes, it has. It is just an example of the kinds of practices in which we would not engage in the UK.

Q42 Chair: And it never happened in the first place. There was already evidence of leaks of methane into the tap water in that area.

Professor Thomas: I think it has to be said that we have a solid regulatory system. If Richard’s predictions are correct—and that is a big, big if—you would have to scale up the capability to regulate, to manage and to inspect, but we are not there yet. That is part of the risk development and risk escalation phase—whatever the right phrase is.

Q43 Mr Williams: How robust is the American regulation regime now to deal with issues like that?

Professor Thomas: I am not too familiar with the US system, but I can tell you about ours. The UK industry has been drilling holes successfully. Our view as a group was that, if there was going to be the sort of exploitation that Richard has talked about, that needed to be developed further to make it fit for purpose. I think the Government’s response is positive and that they are moving in that direction already. As the estimates and everything else become clearer, everything needs to keep pace with that.

Q44 Stephen Doughty: Obviously the process creates large amounts of waste water, significant amounts of which will come back up to the surface, potentially, during the process. Where does that go? How do you see its being dealt with in an environment such as the Vale of Glamorgan or elsewhere in south Wales?

Professor Thomas: That is a very good question. If it goes ahead, those are really important areas to focus on. The water treatment issue needs to be addressed. In a sense, it is no different from any other major industrial process—you would have waste water, and that waste water would need to be properly addressed. It would have to be cleaned up before it could be discharged back.

Q45 Stephen Doughty: So you would need central facilities to be built alongside a fracking area to deal with it.

Professor Thomas: That is one possibility. It would be up to the organisation doing it to decide exactly how it wanted to do it, subject to the regulatory regime. You are absolutely correct to say that it is not clean water; it definitely needs treatment. Those are some of the issues that we put in a wider context. We as a group felt that groundwater contamination and seismicity were not at the highest level of those issues and were possibly distracting attention from some of the other issues that needed it.

Professor Davies: In the US you can do two things with it—you can clean it or you can inject it. You cannot inject waste water in Pennsylvania because they do not have the right geology, so they have to clean it there. Pennsylvania is a good analogy for the UK because we cannot inject it deep underground, unless it is going into an old oilfield to enhance recovery from that. We do not have enough oilfields to get rid of all the water. In Pennsylvania, what we have seen is the development of a water-cleaning industry and new technology and innovation that are part of the supply chain to handle the flow-back water.

Q46 Stephen Doughty: So in a place like the Vale you would have to clean it and then discharge it into the Bristol channel or somewhere like that.

Professor Davies: You would have to clean it. That is what happened to the water from the Lancashire borehole. It was cleaned and then the clean water was put into the Manchester ship canal. The analysis of the flow-back water is in the public domain, on the internet, if you want to see it.

Chair: We must have some fairly speedy questions now.

Q47 Simon Hart: On this particular point, I know that in the south of England—particularly Hampshire and the Test valley—there is significant concern about the impact fracking would have because there are aquifer-fed rivers that have a huge social and economic impact on the area anyway. It is not just about how you put clean chalk-stream water back into the system—it is about the vast volume of water that would be required in the first place. There are concerns that that would lower the overall level of the aquifers and therefore have a pretty significant effect on the whole ecosystem of the whole of the south of England. Is that a legitimate concern?

Professor Davies: I am not an expert on water, but I will say this: you need between two and 16 Olympic swimming pools of water to do a fracking operation in the United States. Where you have low levels of water—as in southern England during a hosepipe ban—of course that sort of water is material and important. Compared with how much water is used in power generation and domestically, it is a very small percentage, but nevertheless, if you have a shortage, it is obviously important.

Q48 Geraint Davies: Professor Davies mentioned that the regulatory system is not razor sharp. Environment Agency Wales has been separated from the Environment Agency for England and Wales, and Natural Resources Wales is looking after things. Is that regulatory regime robust and big enough to cope with the emergence of fracking on a big scale?

Professor Davies: I want to clarify what I said. I was talking about well checking, in particular, not the whole environmental and regulatory regime. On well checking, I think we could do a bit better in the UK as a whole. About half of the wells that have been drilled in the UK were owned by companies that do not exist any more.

Q49 Geraint Davies: The question is about Wales specifically.

Professor Davies: I suspect that in Wales the same system applies. I doubt that well checking is done quite as well as it is done in Pennsylvania, for example, but if there is any local knowledge I will stand corrected.

Professor Anderson: Going back to regulation, no one has mentioned carbon dioxide, but unfortunately no one is regulating the CO₂ at the moment. I do not mean the methane emissions themselves—I mean actually getting this stuff out of the ground. We may be concerned about the local environmental impact, but no one has raised any concerns about the global environmental impact. I find that a little worrying, given that the Welsh Government set up the Climate Change Commission well before the UK Government set up the Committee on Climate Change. They have been one of the leading Governments on climate change, yet there are no significant concerns or questions about—

Q50 Geraint Davies: If there were hundreds of wells in Wales, would they be regulated properly?

Professor Thomas: Like any other place, Wales would need to develop its regulatory capacity if that level of well drilling took place. The primary responsibility for well drilling lies with the Health and Safety Executive. In our report, we advocated that an environmental impact assessment should come in as well. What is happening today is that the Environment Agency—certainly in England—is talking to the Health and Safety Executive about doing that.

I do not know all the details in Wales. I know that Environment Agency Wales is being challenged at the moment on shale gas, along with all the other unconventional gas. From private conversations with people at the agency, I know that they are looking at this and working on it. However, I make the point again that, if this were to develop to this scale, there would need to be a commensurate increase in the capacity to do things. More people would need to be employed and trained. As you know, at the moment the initial approach goes to a local authority. That seems fine at the moment because there are not many of them, but, if Richard's scenario came to pass and there were hundreds, you do not need me to tell you that you would have to increase the capability to manage that.

Chair: Glyn, do you have a last question?

Q51 Glyn Davies: I was going to come in on the regulatory regime, but we have covered most of that. There is one question that has been in my mind for quite a while. We covered visual impact very early on in our discussions. That is something that interests me quite a lot. We talked about the site for one well being the size of a cricket pitch. If we have a very deep seam and horizontal drilling, we can put a lot of wells on one particular site. We might find that that happens more in the UK than in the US because the seam may be thicker in the UK.

Are we still talking about each well being the size of a cricket pitch, or could you have 10 or 20 wells on a site not much bigger than for one?

Professor Davies: That is right. You have physically to move the rig—if you think how big a rig is—to drill the next one, to shift it again to drill the next one and so on. As close as you can do that will be the spacing of the 10 or 12 wells.

Glyn Davies: That is all I wanted to understand.

Chair: Gentlemen, thank you very much for coming in this morning. I would like to call the next panel.

Examination of Witnesses

Witnesses: **Trefor Owen**, Executive Director for National Services, Natural Resources Wales, **Gareth Clubb**, Director, Friends of the Earth Cymru, and **Nick Molho**, Head of Policy, Climate and Energy, WWF-UK, gave evidence.

Q52 Chair: Good morning. Gentlemen, we know who you are, but would you like to introduce yourselves for the record?

Gareth Clubb: My name is Gareth Clubb. I am director of Friends of the Earth Cymru. I would like to put on record my disappointment that Welsh-language translation facilities were not made available, despite my request.

Q53 Chair: You could have come to Cardiff if you had wanted to and given evidence in Welsh, but we thought that Friends of the Earth believes that defending the environment is more important than any other issue and wanted to welcome you here as soon as possible.

Gareth Clubb: Thank you for your welcome.

Nick Molho: I am Nick Molho, head of climate and energy policy for WWF UK.

Trefor Owen: Good morning. I am Trefor Owen. I am an executive director with Natural Resources Wales.

Q54 Chair: Mr Molho and Mr Clubb, you will have seen that fracking is being widely used in the United States. As a result, its CO₂ emissions are about half what they were in 1990. That is probably quite good news, isn't it? Why aren't you both supporting fracking?

Nick Molho: I find the US example very interesting because it has often been portrayed as a great example of cost-effective emission reductions over the last 10 years. What is interesting is that that omits two important things. First, between 2000 and 2005, the share of US coal that was being exported to foreign markets was in the region of 5%. By 2012, and in parallel with the development of shale gas extraction in the US, the share of exports had rocketed to 12%—an increase of around 150% just over the last few years. That coal is being shipped to other markets in Asia and parts of Europe, where it is being burned and adding to global greenhouse gas emissions. That impact is often forgotten in the shale gas arguments.

Q55 Chair: What you are saying is that we should encourage companies that are buying US coal to switch to other energy sources. If they, too, switched to fracking, that would reduce CO₂ emissions quite drastically.

Nick Molho: I think this misses one important reality, which Kevin Anderson touched on in his testimony, which is around the overall impacts of fossil fuels and gas on climate change. I want briefly to drill into this. There are two important elements to it.

First, at a global level, earlier this year, the International Energy Agency made it clear that in order to have a 50:50 chance of staying under 2°C, which is the level commonly described by climate scientists as the threshold that constitutes dangerous climate change, two thirds of currently proven fossil fuel reserves would have to stay underground. The figure for gas is just under 50%. What the IEA describes as currently proven fossil fuel reserves are reserves that have been technically discovered, are recoverable and can be extracted with a 90% certainty of making a profit, so it is a very small pool of the overall fossil fuel reserves that actually exist globally.

Secondly—bringing this debate back to the UK—one of our big concerns is that we are seeing links showing that the exaggerated hopes that have been pinned on the impacts of shale gas exploitation in the UK risk developing an energy policy that is far too biased towards an excessive reliance on gas or the construction of excessive amounts of gas infrastructure. I think this creates two sets of risks for the UK. First, it risks busting our carbon budgets. The Committee on Climate Change has been very clear that both on the heating side and on the power sector side our reliance on gas needs to go down significantly during the 2020s. Secondly, it also risks undermining the long-term policies we need to attract a significant amount of investment in low-carbon infrastructure. That investment is key not only for meeting our carbon targets but for keeping the lights on, for accelerating the cost reductions of renewable technologies and other new forms of low-carbon technology and for protecting our energy bills from an over-reliance on fossil fuel price variation.

Gareth Clubb: There is no example of a fossil fuel having displaced another fossil fuel. Every fossil fuel that is exploited is additional. In the absence of an internationally binding global agreement on carbon emissions, that will continue to be the case. The only exception to that might be peat, and I do not think that is even classed as a fossil fuel. When the US has heavy exploitation of shale gas, that means that the coal is not displaced but used elsewhere, and it is additional.

Q56 Chair: So would you be happy if we switched some of our coal-fired power stations to shale gas-fired power stations?

Gareth Clubb: The problem is that those emissions are all additional. If we do not use the coal, someone else will use it. Without a binding global agreement on limiting greenhouse gas emissions—

Q57 Chair: So why don't you support nuclear? That gives large amounts of base-load electricity with no CO₂ emissions.

Gareth Clubb: It is not without CO₂ emissions; it is what is classed as low carbon. We can get to a very low-carbon future without going down the route of highly expensive nuclear power, where there is no solution to the nuclear waste.

Q58 Chair: By using highly expensive offshore wind, for example.

Gareth Clubb: By using offshore wind, which by the mid-2020s will be cheaper than the nuclear deal that was announced at the start of this week.

Q59 Chair: With all due respect, you were also opposed to the Severn barrage, which would have produced electricity with no CO₂. You oppose gas, which produces lower amounts than coal. You are opposed to nuclear. It is a bit hard to see how you think we can produce the electricity that we all desperately need.

Gareth Clubb: You might ask the Welsh Government, because they have a target for double the electricity consumption of Wales to be produced from renewable sources by 2025. That is their target.

Nick Molho: May I quickly touch on the question of the relationship between coal and gas in the UK market? We have to remember that the UK is not faced with a false choice between a heavy reliance on coal, on the one hand, or a heavy reliance on shale gas, on the other. Not only is the Committee on Climate Change clear that reliance on gas needs to diminish quite substantially in the 2020s—the figure for the power sector is in the region of 10% of electricity demand by then—but a mounting amount of evidence from both the International Energy Agency and from the latest study of electricity market reform by the Committee on Climate Change shows that the move towards a low-carbon power system is not only technically feasible in the UK over the next 20 years but also economically desirable. For instance, using the future gas projections from the International Energy Agency, the CCC showed that, by reducing reliance on gas, UK consumers could save between £25 billion and £45 billion over the lifetime of low-carbon infrastructure, because you are reducing your exposure to long-term rising gas prices.

Chair: I think that is questionable.

Q60 Glyn Davies: I am interested in a similar area—relative to cost, and the way it might displace coal or otherwise. I have heard your view that in the States the coal is being exported and used elsewhere. That may happen there, but in Britain we are currently using a huge amount of coal, which will come to an end fairly soon—in 2015, I think. Irrespective of what anybody thinks, a lot of that will be filled by gas in the short term. Don't you think it is better that we should access that gas in Britain rather than import gas, which we are currently doing? Either it will come from overseas or we could, through shale gas development, produce it here.

Nick Molho: There are two important dimensions to that. One of them is, what time frame are we talking about when we talk about shale gas exploration and exploitation in the UK? Separately, what actually sets the gas price that we pay in the UK? In answer to the first question it is clear that, given the maturity of the UK shale gas sector in terms of the state of the onshore drilling market, the fact that we are at the exploration stage and the fact that we have a lack of mid-stream gas infrastructure such as the gathering pipes that bring the raw gas to processing facilities, in the theoretical case that the UK has large amounts of cheaply exploitable shale gas reserves, those would not come on stream until the early to mid-2020s. Even the work that Pöyry did for Cuadrilla highlights this. So shale gas is not an answer to our short-term issues with respect to security of supply.

The second point I would make is that the evidence that has been published to date by Bloomberg, from Ernst and Young and from the International Energy Agency suggests that UK shale gas cannot be extracted cheaply enough, fast enough and in enough volume to take over the price-setting role for gas from imported gas. In other words, in order for the price materially to change in the UK, the question is not only one of reserves but one of the speed at which you can actually extract the gas to offset the market dynamics. The

conclusion that Bloomberg reached in its latest report on shale gas was that the likely price for UK shale gas would be between \$8 and \$12 per unit. That is very similar to the price of gas we have seen on the spot market in the UK over the last two years, precisely when energy bills have been high. Now, the second—

Q61 Chair: Mr Molho, I admire your enthusiasm, but I ask you to be a bit shorter with your answers.

Gareth Clubb: I would like to add one thing. Coal does not stop in 2015. The two coal-fired power stations in Wales are not slated for closure under the large combustion plant directive, so there will still be a substantial amount of coal being burned in 2015. Would gas be helpful in terms of supply? There are enough gas supplies around the world to fry the planet. The answer is that it is not of benefit in terms of the global emissions portfolio to be extracting shale gas in Wales.

Q62 Glyn Davies: This is a really interesting area. I am thinking in terms of the mid-2020s, when shale gas might come on. We are assuming that shale gas may be accessible and competitive; I would not say that it will be cheap, but it will be competitive. I am talking about 2020, when we will see fantastic growth across the world for gas supplies in places such as the far east. The gas that we have been accessing in Britain, coming in through the Haven, where we were last weekend, and other places, will just come to an end, because the far east will want all of it. They will pay a higher price for it and will take it. We are putting ourselves very much in the hands of those who might want to sell us gas at a very high price when we have to reduce our own access to energy supplies in Britain.

Nick Molho: I think this overlooks the recent dynamics that we have been observing in the far east, in particular. As the International Energy Agency and the Pew Center recently made clear, we have seen nine consecutive years of growth in low-carbon investment in the far east, with China now being the biggest investor in renewable energy. Just in 2012, China spent \$65 billion on the deployment of renewables. The IEA has observed that in 2012 the significant increase in energy efficiency and renewable energy deployment in China slowed down the rate of growth of Chinese emissions for the first time. There is a growing appetite for lower-carbon sources of energy in the Asian region that will partially offset that dynamic.

Gareth Clubb: Your point is actually a strong incentive for us to develop our own zero-carbon renewable infrastructure here in Wales and in the UK. The fuel used for renewables has no cost. We know already that, according to Cuadrilla, the fuel from shale gas will have a basically insignificant impact on fuel prices. Gas prices are volatile and are likely only to increase over time. What we need to do is to focus on zero-fuel-cost renewables.

Q63 Stephen Doughty: I want to move on to some of the local impacts. I am aware of your concerns about the global impacts—the greenhouse gas emissions—but we asked the previous set of witnesses about the process itself, potential contamination of groundwater supplies and the waste water. What are your views on the local environmental impacts and how things such as water contamination and disposal of waste water can be dealt with effectively—or can they not be?

Trefor Owen: It is important to recognise at this stage that, as far as Wales is concerned, we are talking about a hypothetical situation because we do not have any wells that have been drilled. We are at that point in the process. If a proposal comes forward, Natural Resources Wales will look at the evidence on groundwater reserves. If that is a source for

water companies to draw water for potable water supplies in what we call source protection zone 1—in other words, the highest level of classification—there will be a straight objection to any drilling, with no hesitation.

Beyond that, we expect operators to provide us with details of any liquids or substances they may want to use in this exercise and of their disposal and, indeed, water use subsequently. We would apply a methodology based on the groundwater daughter directive—it is called the groundwater daughter directive; everybody asks about that—to assess whether a substance was hazardous or non-hazardous. If a substance was deemed to be hazardous, again a permit would be refused.

We would also ask the operators to provide us with a waste management plan. Earlier, one of the professors described how that would be used. We would obviously monitor that through audits, spot checks, site visits—

Q64 Stephen Doughty: So you would have the clear regulator role if, for example, they were proposing to put waste water into rivers in the Vale, out into the Bristol channel or elsewhere.

Trefor Owen: Exactly. They would have to apply for a number of permits under the environmental permitting regulations—up to 11 in total. I have touched on one. The mining waste directive would also require a waste management plan. Again, we would want to see how that water was to be treated.

Q65 Stephen Doughty: I have one last point. You described it as hypothetical at this stage, but you must be looking at the longer-term horizon—where this may be going, given the intention of some of these companies. Do you feel that the regulatory regime as it stands is ready to cope with this, or would it have to adapt and change to cope with the potential scale the previous set of witnesses talked about?

Trefor Owen: The Environmental Permitting Regulations 2010, which we would apply in Wales for all onshore oil and gas, are regarded as robust and well understood. I should also say that the position is consistent with that of England.

Q66 Geraint Davies: There has been a bit of concern. Obviously, Natural Resources Wales is a new organisation and its critical mass is quite a lot smaller than that of the Environment Agency in England. You have been criticised for not insisting on certain permits such as a radioactive waste permit for unconventional gas exploration in Wales, unlike the Environment Agency in England. Do you have a response to that particular criticism and to the general case that you are now a small beast in the park at a time of enormous change and environmental exposure through shale gas exploitation?

Trefor Owen: Let me clear up any misunderstanding to start with. As I just said, the regulatory approach that we adopt in Wales is based on the Environmental Permitting Regulations 2010. That is entirely consistent with England. We have also clarified that position to developers and others in Wales.

Your second point was about our capacity and capability. It is important to say that a number of the staff who transferred across from 1 April to Natural Resources Wales were working before then—as part of a larger team, as you would expect—on developing guidance and methodologies. We have that team in place, but what is very important is that we have maintained clear relationships with colleagues in England, through a knowledge transfer agreement and a project board. In an area as complex as this, it

obviously makes good sense for countries to be working together, as we are between the Environment Agency and Natural Resources Wales.

Gareth Clubb: We do have concerns about regulation, in relation to both the Welsh Government and Natural Resources Wales. Other than this one page, the Welsh Government have no planning guidance on onshore oil and gas. Out of all the thousands of pages of planning guidance that the Welsh Government have, that is the sum total of everything to do with shale gas and underground coal gasification.

Q67 Chair: I would say it is admirably concise.

Gareth Clubb: That is one way of looking at it. According to the WLGA, “The view from local planning authorities is that there is a lack of Planning Policy Guidance/Technical Advice Note/Best Practice notes etc with regard to fracking and assessing planning applications for that form of development.” There is no technical advice note and no mention of it in “Planning Policy Wales”.

Chair: I will say for the record that that was one page, so that the transcribers know what it was.

Q68 Mr Williams: What is your understanding of why that is the case? Notwithstanding what Mr Owen said about co-operation between England and Wales, which is important, why has there been a reluctance to produce a technical advice note?

Gareth Clubb: I can theorise. This dates from December 2000. One theory is that the Welsh Government are quite happy to go along with what Westminster is doing, but do not want the responsibility or accountability or to act in a transparent manner, because that would mean that local communities in Wales that are opposed to these developments in their area would be able to point the finger at the Welsh Government and say, “Why aren’t you doing enough to protect us?”

Mr Williams: We have some history of that in other areas.

Q69 Chair: I invite Mr Molho to comment. Perhaps Mr Owen can then speak for the Assembly Government.

Nick Molho: May I make a brief comment in relation to the Environment Agency and the situation in England? One of our local concerns is to do with well integrity and the potential impact that this may have on groundwater contamination. A recent study by the European Commission suggested that around 5% of fracking wells may be impacted by the issue of well integrity—in other words, that the well is not sufficiently well sealed from the external environment to prevent contamination. In the theoretical example of the UK sitting on significant reserves of shale gas and having its own shale gas revolution, Bloomberg suggests that this would require at least 1,000 wells per year at the peak of activity. Given the significant staff cuts that the Environment Agency has suffered over the years—further ones were announced last week—I have concerns about whether the Environment Agency will be in a position to provide the robust oversight that this issue requires going forward, especially if this shale gas revolution materialises in the future.

Trefor Owen: I will certainly not speak for the Welsh Government. I understand that the Welsh Government have provided the Committee with evidence on their position on shale gas. I understand that they believe that their national planning policies and supporting guidance provide a robust precautionary approach to this particular subject. I think they

also said in their written evidence that they would review that in the light of practice and evidence.

It is important for me to underline that Natural Resources Wales respects the wishes, or the views of both Governments. It is clear that the UK Government and the Welsh Government have different approaches or attitudes to shale gas, but our focus is on ensuring that we base decisions on good evidence and a clear understanding of the uncertainties. We will assess each case on a case-by-case basis, using the Environmental Permitting Regulations 2010.

Q70 Nia Griffith: I want to pick up the issue of environmental assessment. In the evidence from Friends of the Earth, Gareth Clubb alluded to the fact that there does not seem to be a requirement for an environmental impact assessment, which you would expect with any sizeable development. Why do you think that situation has arisen? Do you think that there ought to be such a requirement? If an environmental impact assessment were made for any suggested fracking development, that would at least be an interim solution before a technical advice note became available.

Trefor Owen: In this instance, the environmental impact assessment is part of the planning process. Using the regulations, the local planning authority can initially screen the need for, and then demand the production of, an environmental impact assessment.

Q71 Nia Griffith: Do you think there should be a stronger recommendation—not just that the local planning authority can screen, as it does for all applications, and then decide to have one, but that it should be mandatory to have an EIA for any fracking operation?

Trefor Owen: That is a matter for the Welsh Government and the planning authorities to discuss. What I can say is that Natural Resources Wales would be invited through the planning process, as a statutory consultee, to provide advice on the screening and on what should be considered within an EIA if one were demanded. We would also be invited to comment on a completed environmental impact assessment, again as a statutory consultee to the local planning authority.

Nia Griffith: If the authority decided to ask for one.

Gareth Clubb: There may be some confusion here, so let me try to clear it up. There is unlikely to be an environmental impact assessment unless Natural Resources Wales takes the view that there would be an environmental impact worth assessing. When an application for an EIA was requested by the Vale of Glamorgan, Natural Resources Wales said, “Our view is that such developments are unlikely to have significant effects, and we would not ask for an environmental impact assessment to be undertaken.” It is specifically and absolutely ruling out an environmental impact assessment for exploratory drilling.

Q72 Nia Griffith: Following on from that, what would you like to see happen?

Gareth Clubb: There should be a default that environmental impact assessments are required for all of these developments. The reason they are not required is that these developments tend to be 0.99 hectares. If they were 1 hectare, an environmental impact assessment would be required. I do not think that size threshold is a reasonable threshold to use to allow this industry to evade what any other industry would be required to do—an environmental impact assessment for something that could have environmental impacts, which are unlikely to be revealed unless you do that EIA.

Q73 Simon Hart: I want to go back to one point you mentioned earlier, Mr Clubb. You used the expression “zero-fuel-cost renewables”. What does that mean? How is it achieved competitively in Wales?

Gareth Clubb: For all renewable technologies—wind, solar or tidal—other than biomass burning, which I would consider to be a separate compartment in any case, the fuel costs are nil. They will always be nil because, by its nature, it is provided by the environment. For Wales, that means that the higher the proportion of your energy that you get from renewable sources, the better you can know what your energy costs will be. As Nick mentioned earlier, there are very substantial economic benefits to moving rapidly to renewables, as opposed to a dependency on fossil fuels, which are volatile in terms of price and are likely only to increase in price.

Q74 Simon Hart: If we take Wales specifically, what proportion of current demand, let alone future demand, could be delivered as a result of those technologies?

Gareth Clubb: The Welsh Government target is for double our electricity demand to be met by renewable sources by 2025. In 2011, the latest year for which statistics are available—

Q75 Simon Hart: Double from what to what?

Gareth Clubb: Double the entire electricity demand of Wales. Electricity demand in Wales has been reducing year on year for about the last five years and is now about 12% less than it was five years ago. Gas use is down by about 26%, so we are reducing our energy consumption.

Q76 Glyn Davies: That is the recession.

Gareth Clubb: It predates the recession, Glyn. However, the 2025 target is a very substantial one. In 2011 we were generating 8% of our electricity from renewable sources, which leaves 192% to be found by the Welsh Government somewhere between now and 2025. There is a problem, which is that the Welsh Government do not have the powers to be able to deliver on that. They may as well have a policy on space exploration as on energy, because they do not have the powers.

Q77 Simon Hart: Can I press you on that? I am trying to get to what proportion of the demand could be met if they had all of these powers devolved to them. You talk about double the demand but, like most people, I do not actually know what the figures are. I am trying to get a rough estimation of the percentages from and to which we are going and, therefore, when you get to the bottom of your equation, of the extent to which Wales will still be dependent on imports or fossil fuel energy production.

Gareth Clubb: Okay. Denmark, for example, has stated that all of its heating, electricity and transport needs—

Q78 Simon Hart: Who has?

Gareth Clubb: Denmark.

Q79 Simon Hart: This is about Wales.

Gareth Clubb: This is to give you an illustration.

Q80 Simon Hart: I do not want an illustration. I want to know what you think we can do in Wales.

Gareth Clubb: Wales could do exactly the same.

Simon Hart: I do not care about Denmark.

Q81 Chair: You are saying that Wales could do what Denmark is doing.

Gareth Clubb: Wales could do what Denmark is doing.

Q82 Chair: What has it done?

Gareth Clubb: Wales could say exactly the same thing, which is that all our electricity needs will be met from renewable sources by 2025 and that our entire energy needs will be met from renewable sources by 2050, so there would be no need for fossil fuel.

Q83 Chair: What has that done to its manufacturing industry?

Gareth Clubb: The Denmark economy is performing much more strongly than the Welsh economy or the UK economy.

Q84 Chair: How much electricity is it buying from the French?

Gareth Clubb: It exports electricity to Germany—very competitively.

Nick Molho: To answer your question at the UK level, which I hope will be helpful, in 2011 renewables provided 10% of UK power, on average. On the projections going forward, a wide range of reports such as the offshore valuation report that was done by Government and industry and the work that Pöyry did for the Committee on Climate Change suggest that renewables could provide 60% or more of UK electricity demand by 2030. Clearly, there is potential beyond that for the percentage to increase, although a clear challenge for the UK is the importance of increasing its interconnection links with the rest of Europe. In order to maximise its renewable electricity potential, the UK needs to have export routes to Europe to enable it to share some of the excess power at times of lower demand. That would bring economic benefits with it. That is why we have been calling for the UK Government, alongside their energy policy, to have a strategic interconnection strategy with their European partners, to make sure that we can guarantee system security and maximise export opportunities in a way that is as beneficial as possible to our economy.

Q85 Jonathan Edwards: Gareth, you gave a very enlightening answer just now: essentially, the Welsh Government are putting on the blindfolds, sticking on the earmuffs and pretending that the UK Government's dash for shale gas is not happening. If that is the case, are you saying that the Welsh Government are not protecting Welsh communities from the dash for gas and the potential exploitation of Welsh shale resources?

Gareth Clubb: What I am saying is that the Welsh Government are depending on the framework that is set by the UK Government for England to protect Welsh communities. If I were living in a community that had the potential for shale gas extraction to take place, I—like every community in Wales where this is proposed—would join a campaign against it, because I am not convinced that the regulatory framework is strong enough. The Welsh Government have been absolutely negligent in terms of the planning framework that they have applied to shale gas and unconventional gas.

Q86 Jonathan Edwards: So at the very least should the Welsh Government—and the National Assembly, for that matter—be working towards coming up with a technical advice note for unconventional gas?

Gareth Clubb: Absolutely.

Q87 Chair: Would you be willing to break the law, if necessary—to commit acts of trespass and so forth?

Gareth Clubb: I am a law-abiding citizen.

Q88 Chair: So you would condemn the actions of the Green Member of Parliament who committed an act of trespass.

Gareth Clubb: I am a law-abiding citizen, but I do not pass comment on other people's activities.

Q89 Chair: I want to come back to something you said. With the joys of modern technology, I was able to look on Wikipedia, where I noticed that the Danes pay the highest household electricity prices in the world. Is that the model that you would like to see in Wales?

Gareth Clubb: I would imagine that we are not far off it. I would also say that, if we continue our dependency on fossil fuels, before too long we will overtake Danish prices, because Danish prices are largely, and will increasingly be, predicated on zero-fuel-cost sources.

Chair: Let us hope so, for their sake.

Q90 Jonathan Edwards: I have a question for Natural Resources Wales. Your evidence states that you are working towards “one voice” guidance for developers, operators and local authority planners. What does that mean? Can you expand on it?

Trefor Owen: We are currently using guidance that was developed by two of the predecessor organisations, the Countryside Council for Wales and the Environment Agency Wales. Since 1 April, as one organisation, we have provided a single voice to respond to requests for planning advice. We have now put in place a work plan to develop that guidance further to reflect the purpose and remit of the new organisation. We will be working that up over the next few months.

Chair: Geraint Davies has some further questions.

Q91 Geraint Davies: I want to come back to Trefor Owen. In the light of what Gareth Clubb has been saying, do you feel that there is a case to be made for the Welsh Government to come up with new TAN guidance at a lower level than the one at which you normally intervene to protect communities from the sorts of problems of environmental impact we have been talking about today, given that the number of these may be scaled up across Wales?

Trefor Owen: That is obviously a question best answered by the Welsh Government. What I can say to you today as an environmental regulator is that the current planning in Wales and the guidance that is issued to planning authorities and others, as well as the energy policy that is reserved here at Westminster, really have no impact on our ability to act as an independent environmental regulator. We feel confident that we are able to apply the Environmental Permitting Regulations 2010 across this particular sector, as we do across many other sectors that we regulate.

Q92 Geraint Davies: In terms of the integrity of the drilling pipes and the fracking and the release and cleaning of waste water, do you have sufficient powers to intervene, to prevent or to do impact assessments across the range of developments that would be exposed to Welsh communities?

Trefor Owen: The Environmental Permitting Regulations 2010 mean that developers will have to obtain up to 11 different permits, licences and consents to operate. This is an approach that is used in England and in Wales and that has been in place for some time.

Q93 Geraint Davies: Are you saying that the regulatory regime in Wales is as strong and robust as the one in England and will continue to be so in relation to the development of shale gas?

Trefor Owen: Yes.

Gareth Clubb: I think there is some conflict between what Trefor has said and what his written evidence said. In its written evidence, Natural Resources Wales said, “we would welcome further guidance and a policy framework from the UK and Welsh Governments” in relation to shale gas. What he said just now seems to contradict that. He seems to be saying that the planning framework would have no bearing on the regulatory side of things, whereas NRW “would welcome further guidance and a policy framework.” That seems to suggest that there is no policy framework from the Welsh Government—something I would agree with, actually.

Trefor Owen: Can I come back on that point? I stand by what I just said in response to Mr Davies. Looking ahead, we are aware that there is now an opportunity to input into the next round of PEDL areas. We said in our evidence that we think that future developments should be directed away from protected areas; we are thinking here of national parks, AONBs and so on. We have commented on a scoping document for a strategic environmental assessment that is part of developing the new round of PEDLs. When that process is completed, we would like to see some feedback on how our evidence has been considered.

Q94 Geraint Davies: On that point, you are a new amalgamation of the Environment Agency Wales, the Countryside Council for Wales and the Forestry Commission. If you were the separate bits of that, wouldn't the Countryside Council, in particular, be talking much more strongly and publicly about the need to protect environmental spaces, not just for their own sake but for tourism and economic benefits?

Trefor Owen: The one voice that I mentioned in response to Mr Edwards's question is about providing one voice on planning advice, in particular. We have a number of duties that we have to take into account, some of which were previously undertaken by separate organisations. We now have to consider our position by bringing together different opinions, against different duties, but ensuring that we provide one voice in doing so.

My comments on how we would like to influence the new PEDLs are really a signal to the UK Government about energy policy, rather than planning policies back in Wales because, obviously, energy is a reserved matter.

Q95 Nia Griffith: I am sorry to say this, but the impression out there is that CCW's voice is being silenced by the new organisation, in the sense that people have always perceived the EAW as having a less stringent approach, perhaps, than CCW. There is a concern that we may be losing something in having Natural Resources Wales. Is there any way that you can be certain that you are incorporating exactly what Geraint just said about CCW and the possibility that it would have raised more concerns?

Trefor Owen: I can assure you that the expertise from different parts of the organisation is working together very closely to ensure that we produce a single voice when giving planning advice.

Q96 Geraint Davies: Is the idea that national parks and areas of outstanding beauty should be exempted from fracking activity, possibly?

Trefor Owen: That is the advice we have submitted as part of the scoping exercise for an SEA, but that is about developing what is effectively part of an energy policy here at Westminster.

Gareth Clubb: I have two final points in relation to regulation. The first is that the spokesperson for the shale gas industry said in evidence to the Energy and Climate Change Committee, “Regulation is to be welcomed and will not add any significant costs.” We are in the unusual position that local communities, the industry itself, environmental NGOs and just about everyone else, except for the regulator and the Welsh Government, are in favour of more or better regulation.

The second point is that Natural Resources Wales is now a large landowner. There may potentially be shale gas resources under that land. It is probably fair to assume that there will be exploration activities. Under a European directive, a separation of functions is required between the part of the organisation that deals with regulation and the part that promotes a plan or programme. Can I find any process that has been set up to ensure that that European requirement is in place? No. Is there any published document showing that that has been put in place? No. Trefor could save me the trouble of a freedom of information request if he were to tell us right now what the status is internally, because it is now a long time after the formation of that body and it should have been in place on 1 April.

Q97 Chair: Mr Owen, do you want to come back on that?

Trefor Owen: I can assure the Committee that there is a separation of duties between the land management functions, the teams that provide advice to planning authorities and the permitting teams. We would be very happy to share that explanation with Mr Clubb and with the Committee.

Q98 Chair: Excellent. Mr Clubb and Mr Molho, we see that somebody from Wales is currently imprisoned in Russia as the result of a protest against a Gazprom oil platform. Would it be fair for me to assume that neither of you two gentlemen is a great fan of Gazprom?

Gareth Clubb: It is a large corporation that is involved in fossil fuels. There is a role for fossil fuels in a very rapid transition to a zero-carbon future, but it is a rather subjective—

Q99 Chair: The reason I ask is that today *The Wall Street Journal* has an article about a statement this week from the board of directors of Gazprom, who are apparently very concerned about the environmental problems that fracking could cause. What do you make of this new-found environmental crusade by Gazprom? Do you think it is genuine or possibly motivated by other concerns? Do you think the directors of Gazprom will be joining you on one of your next protest marches?

Gareth Clubb: I find that unlikely. I imagine their new-found enthusiasm for the environmental implications of fracking is largely to do with self-interest.

Q100 Chair: Indeed. If you want to get your own back on Gazprom and the Russians, who are imprisoning one of your colleagues, wouldn't it be quite a good idea to think about supporting a well-regulated, well-run British shale gas industry, rather than increasing our dependence on gas from Gazprom?

Nick Molho: Again, I think this runs counter to the economic evidence that we have to date from the likes of Bloomberg, Ernst and Young and the International Energy Agency, all of which suggest that UK shale gas will not be extracted cheaply enough, fast enough and in enough volume to offset the role that imported gas currently plays in setting the price for gas. It is important to remember that the UK is part of the European gas market. In order to understand the gas price that we as UK consumers will be paying in the years to come, we have to understand the projections that are being made for future European gas prices. What the International Energy Agency shows—this is highlighted very clearly in its “Golden Age of Gas” report—is that, even with a strong expansion of shale gas throughout Europe, the trend for gas prices is up, all the way from here to 2035.

Q101 Chair: Yet of the two main companies that are involved in this, one is publicly listed and its share price is going up at the moment. A lot of people are putting their money where their mouth is and think that they are going to make big profits.

Nick Molho: I think this is a very dangerous strategy for a lot of investors, especially shareholders in oil and gas companies. Recently, the London School of Economics and an organisation called Carbon Tracker published a report called “Unburnable carbon”. What this report showed was that, if the world is serious about preventing the worst impacts of climate change and, therefore, preventing temperature rises in excess of 2° C, 60% to 80% of the coal, oil and gas reserves of listed companies will have to stay underground.

Q102 Chair: That may be so, but you said that these companies were not going to make a profit. All I can say to you is that if you look at the share price of the one that is publicly listed, obviously a lot of people are putting their money into it because they think it will make a profit.

Nick Molho: Fundamentally, the point I am making is that economic circumstances and the prospects for fossil fuel exploration are likely to change dramatically if we move towards a binding global agreement in 2015. When we look at the science coming out of the US and out of China, which is considering its own binding emissions cut from 2016 and has already set itself the target of generating 15% of its energy from non-fossil fuel sources by 2020 and an energy efficiency target of 40% by 2020, compared with 2005 levels, there are strong signs that the big players internationally want such a deal to happen. They understand that it is not worth risking the economic, international security and environmental consequences of unmitigated climate change.

Chair: I have given you a good last word, but Nia Griffith has a further question.

Q103 Nia Griffith: Mr Owen, could you provide a note for the Committee on the relationship between the two parts of the EA in order that it conforms to the European directive that there should not be a conflict of interest between the planning side and the land ownership side?

Trefor Owen: I would be very happy to do so.

Chair: Thank you very much.