HOUSE OF COMMONS

Environmental Audit Committee

Oral evidence: Climate Change Adaption, HC453

Wednesday 7 January 2015

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Written evidence from witnesses:

- Federation of Small Businesses

Watch the meeting

Members present: Joan Walley (Chair), Peter Aldous, Neil Carmichael, Martin Caton, Zac Goldsmith, Mark Lazarowicz, Caroline Lucas, Caroline Nokes, Dr Matthew Offord, Mrs Caroline Spelman, Dr Alan Whitehead, Simon Wright

Questions 189–235

Witnesses: **Tony Glover**, Director of Policy, Energy Networks Association, **Professor Jim Hall**, Director, Environmental Change Institute, Oxford University, and Director, Infrastructure Transitions Research Consortium, **Allen Creedy**, Chair, Energy, Water and Environment Policy Unit, Federation of Small Businesses, **John Dora**, Chair, Infrastructure Operators' Adaptation Forum, and **Brian Smith**, Member, Expert Panel on Review of the Resilience of the Transport Network to Extreme Weather Events gave evidence.

Q189 Chair: I am very conscious that this is the first of our new year sessions and the last lap, if you like, before the general election for Parliament. I would like to welcome all of you to our session this afternoon on adaptation.

I may be wrong, but I do not think anyone has been before to present evidence to the Environmental Audit Committee, so I hope that you will find this a constructive opportunity. We want to cover various aspects and I am very conscious we have different interests represented here, ranging from so much different experience across small businesses to infrastructure, so I would ask each of you to be brief. If you want to come in after somebody else, please try to catch my eye, or the eye of whoever is asking the question, and we will try to get through the session that way.

Could I start by asking each of you to highlight in one or two sentences the big issues and challenges that you feel are most relevant to your particular field of expertise and the work that you are doing? I do not know whether you have met before and have a spokesperson among you, but if not, we will just go through in alphabetical order, starting with small businesses, Mr Creedy.

Allen Creedy: Thank you very much. There are just a couple of points that I would like to make to the Committee. We surveyed our members in December about business resilience and the impact on their businesses of extreme weather events. There are a couple of headline figures I would like to share with you: 66% of our members have been negatively affected by some sort of severe weather in the last three years and the most common problems were related to indirect effects. That is disruption to customers and staff, and disruption to suppliers, utilities and transport. The second one, which is quite worrying from our perspective, is that 60% of our members who we surveyed do not have any form of continuity or business plan in place, so they are literally wide open to all the adverse impacts of extreme weather.

I would like to leave it at those two key points. I can elaborate on those and some of the other supporting information later on.

Chair: That is very helpful, thank you.

Professor Hall: My interest here is in infrastructure systems. I run a research programme that is looking at national infrastructure systems. To set the scene I should set out why infrastructure is so important from a climate change adaptation perspective. We have seen sensitivities to extreme weather, and infrastructure decisions are long-lived and hard to reverse in the context of the changing climate infrastructures where they will be exposed to a very different climate in future. Finally, the impacts of infrastructure failure are very wide ranging and potentially disruptive, with major spillovers to the economy and society.

The second point I would make is simply to point out that the principles of how we go about managing climate-related risk to infrastructure are very well established. We need to assess the risks, appraise options in terms of their effectiveness in risk reduction, recognise uncertainties in the future—so, look for robust options that can cope with a range of different futures—and also recognise that one cannot reduce risk to zero, so put in place contingency measures so that systems can cope when they are tested in the most extreme ways.

Q190 Chair: Thank you. In view of what you said, and in view of the publication on 17 December of the national policy statement on the national networks, do you feel that the overall picture of these issues in respect of new infrastructure planning, relating in this case to transport, has been sufficiently grasped by Government?

Professor Hall: The national policy statements all incorporate attention to climate change. An important question is the extent to which the cumulative effect of infrastructure investment is being taken into account in terms of the effect that infrastructure investment and promotion of development and values change may be building up vulnerability to climate change in the future. There is a question as to whether that is completely addressed within the national policy statements.

Tony Glover: From the energy networks' perspective, our members are providing gas and electricity to people's homes and businesses across the UK—not to put too fine a point on it, in effect supplying civilisation—so we are acutely aware in our industry of the critical role that we play in underpinning society and the economy. We are acutely aware of the impacts that bad weather can have. We are obviously regulated for service, but also for what we are allowed to spend. That is critical to our role.

Given some of the adverse weather that we have had over the last year or so—speaking as someone who spent a lot of time last Christmas on national TV and radio explaining to some very upset and badly affected people across the UK why their electricity supply was not on—I am personally acutely aware of the impact that adverse weather can have, and as I speak we have an amber warning for Scotland and the north of England. There is potential for some seriously bad weather towards the end of this week. Our member companies are already gearing up to prepare for that and operating mutual aid, or preparing to operate mutual aid. That is the first point.

Perhaps we need to understand the difference between bad weather and climate change adaptation. Sometimes the two get confused, but in terms of climate change adaptation the key lessons that we have drawn out of the process that we have been working on over the last few years—I am sure we will go into it in some more detail later—is that you work together with the widest group of people possible, you bring in all the stakeholders, you work closely with your economic regulator from day one, and you make sure they are aware of some of the things that are being talked about in terms of what minimum service requirements are and where infrastructure should be improved or adapted, or where extra redundancies should be built into the system. That is critical. Also the people, obviously the critical—

Q191 Chair: Sorry, when you say extra redundancies brought into the system, can I just check that you are using that in the technical sense?

Tony Glover: I am indeed. Basically building extra infrastructure into the system to take account of these sorts of events, which is something that energy networks do, and electricity networks particularly. So there is that aspect, but there is also working closely with some of the energy intensive industries and those who need critical supplies. Some of the experience we had out of the 2007 floods and the post-Pitt process was bringing together different Government agencies as well—bringing together the Environment Agency with SEPA for instance. That is something that we were keen to do and are taking a lead on that.

It is about sharing the information, getting an understanding of what the minimum requirements are and seeing that within the context of the economic regulated process that we live with, with customers' bills on the increase.

Q192 Chair: Is there a vehicle in existence to facilitate the collaboration that you talk about, or is it a question of doing it as it happens?

Tony Glover: There are various vehicles. If we take it back to after 2007 and the floods then, we established a process—a task group that stills exists today—which has led to our standard ETR 138.

Chair: When you say "we", who?

Tony Glover: Sorry, Energy Networks Association. But bringing together everybody—bringing together, as I say, SEPA, Ofgem and DECC. As I speak today, we have a meeting of the task group going on. At the next meeting of that task group—that is an ENA task group—we will have Ofgem, the Environment Agency and DECC present as well.

Q193 Chair: Given the points that Mr Creedy made about the risks that small businesses see further down the line in terms of the effect, is there scope for business and small business to be included in that?

Tony Glover: Absolutely; definitely. Through Energy UK, which represents the suppliers, we are working with customers, and there is also the E3C, the Energy Emergencies Executive, which brings together representatives from business as well. That is an aspect of it, but I totally agree that that is critical.

Allen Creedy: In a survey just before Christmas we asked our members what information they were using and had access to about resilience planning, and the results are absolutely appalling in terms of their awareness and use of information promoted. I think the Environment Agency comes highest with about 22% of our members aware of that. The local authority is 15%, and everybody else is in single figures, whether it is energy networks, Energy UK or distribution companies.

Q194 Chair: It is not working as it should do.

Allen Creedy: It is not getting through. I cannot comment on whether they are doing it, but it is not getting through to the small businesses on the ground.

Q195 Chair: It is a communication issue. Thank you. We will move on to Mr Smith.

Brian Smith: Thank you, Chair. I am here this afternoon as a member last summer of the DfT Transport Resilience Review, which was looking at the resilience of the transport network to last winter's problems.

Just as some overview thoughts from that, as we talked to all of the main transport operators, one point was absolutely clear: there was a lot of awareness of climate change and adaptation was very much on their agenda. However, their focus, as they looked back to last winter, was very much about dealing with the extreme weather, and the disruption and damage, and returning everything back to normal. But we certainly picked up in our discussions that, as they were looking longer term, adaptation was very much on the agenda, and that is important.

Secondly, one thing to flag up is that as we talked to the different operators it was very clear to us that there were some key links. You could not just look at an airport or a port in isolation. You had to think about the link and that led to a critical issue of what we would call a critical network as well; thinking about how you join up. For instance, a port is totally dependent on the landward side in terms of the roads that serve it. Interestingly, having read the report that came out for the infrastructure chapter, it struck me it seemed to focus very much on the Highways Agency links but did not recognise that there are local authority roads that link to some of those as well, which need to be picked up and discussed between the port and the local authorities.

The third point I would make is that you can focus very much on adaptation and the like, but the message that came through and was very clear from last winter is that you can have all these longer term plans about adaptation, but if you do not have your basic maintenance right for drainage systems and the like, you can very quickly find that even at the current level, let alone with climate change and adaptation, you are running into

trouble. So the message of basic maintenance is one that runs right through our report and I think all transport operators recognise that they have to be careful to get that right.

Chair: Thank you. Last but not least, Mr Dora.

John Dora: Thank you, Chair. I am here because I am the Chair of the Infrastructure Operators' Adaptation Forum, which comprises about 50 organisations across the infrastructure sector, including labour leaders and Government Departments, some of whom are represented to my left here.

One of the very important issues that I am picking up from our members, and I have picked up in my own career in flood management and in railways, is that we have a lot of knowledge about climate change impact and adaptation. A lot of it is academically based and we do not have the skills, the knowledge or the capacity in many organisations to take that knowledge from the academic side and translate it into delivery day by day in organisations. I think there is a communication issue there.

We also have in the regulated industry—I am quite familiar with them—five-year control periods, that sort of thing. In many businesses, five years seems very long term, but in regulated industry it is about right for funding cycles. In adaptation I am thinking 30, 50 or 100 years and not many organisations of people think that long term. The capacity to understand the implication for all those long-term periods, with infrastructure asset life cycle sometimes being in excess of 100 years, is quite important.

Joining up the systems, the dependencies and the interdependencies between different infrastructure operators is not generally a business priority. Businesses tend to be focused on what they do. They are less thinking about what happens outside that business, but it is very important that they should. It is not just a technical reliance on things like information and communications technology; governance, regulation and the supply chain are parts of the system. I will come back to supply chain in a minute.

Another thing about infrastructure is that we are very good at looking at building new infrastructure, but the new infrastructure that gets built in the UK is a very small percentage of what is there just now. The mainline railway network was laid out and built by 1850. It is still running on earthworks that were built prior to standards being introduced. Earthworks, embankments and cuttings were built without a formula to say, "This will stand up and this will not," and they are still working on an old infrastructure. We do not know the capability of the vast majority of the stuff out there for current weather, never mind the future. "Weather"; I used that word. Sorry about that.

A challenge I find is terminology. A lot of people think about climate change as extreme weather, but weather is what we experience today. Climate is much more longer term—30-year cycles. We need to think differently and to have the capacity and knowledge in organisations to understand that sort of thing.

The last point I want to bring forward is the supply chain issue. UK industry depends a lot on very long supply chains. The tsunami in Japan was not a climate-related event, but it caused problems with the supply of components for the Honda factory near Swindon. We have these long supply chains. What if we have a climate or weather-related event somewhere in the far east when we depend on just-in-time components for a critical

operation? This is something I do not see considered very much, but it is part of the system that we need to think about.

Q196 Chair: Thank you and thanks for all those contributions. One of the questions we want to try to understand is how much public awareness there is about this, or how much awareness there is across different sectors. In view of the work that has been done so far by the Adaptation Sub-Committee, what is the time line and are there certain sectors that need to be looked at more urgently than others? For example, does transport need to be looked at sooner than energy supply? What is the time scale for being able to make sure that we have everything covered as we face more and more problems with extreme weather conditions?

Professor Hall: I am not sure whether it makes sense to consider prioritisation in terms of timing. There is a sense in which we should be doing it all, but then applying some of that prioritisation in terms of which actions should be done first in the context of each of the networks, so I would not go from one network to the next. I would look at where are the pinch-points within each network.

Within the Adaptation Sub-Committee's work on infrastructure, the committee was looking for critical components in the process of managing the risks. Are risks being analysed? Is there evidence of steps being taken to address the priority risks and is there action in implementing and reporting on those steps? It found a different picture across the piece. There were some examples of very good practice, like in the Energy Networks Association, in areas where it was much more difficult to find out what steps were being taken to adapt networks.

Q197 Chair: Does anyone else what to contribute to that?

Brian Smith: I would agree with that point from Jim, but we also have to start thinking about things like the intensity of use of our infrastructure and link the economic impact to that. We have all different bits of our network around, so you then come back to what are the critical connections. There is a point here also with the supply chain and thinking it all through.

If you come back to the public where you started your question, the public will always be irritated when there is flooding or disruption, but often in the short term there are ways around that. At the local level, if that stays for a couple of months or three months, they become very frustrated, but often it is short term. But if you come back to an example like Heathrow, it is right on capacity the whole time and any disruption has a big knock-on effect. Any short-term disruption on the M25 or any other parts of the critical strategic network has a very major impact, so you have to start thinking in those terms about those impacts. For me, the impacts and the economic fallout is a critical issue, as well as the timing.

Q198 Chair: We will come on to this later. Do you think that the decision-making process for new infrastructure should be linked to replacement or the work that needs to be done for existing infrastructure?

Brian Smith: Yes, absolutely. For new infrastructure I would agree with John that it is relatively straightforward. We know what we need to do and it would be pretty stupid not to be accommodating that in terms of climate change and what we know are the standards

we need for the future. The reality is that the bulk of the infrastructure we have now is the infrastructure we are going to have in 30 or 40 years' time. That is where we need to be thinking because that is what is going to fall down.

Q199 Chair: For small businesses, in terms of the priority for what needs to be done over the next 40 years or so, are there any priorities there, Mr Creedy?

Allen Creedy: The concern of small businesses is that we expect people in government to be doing their job in maintaining the infrastructure, but there is a crying desire from small and micro-businesses to better understand what the likely impacts are going to be on their businesses. There is, as you mentioned, a communication gap—teasing out what the implications are of the failure of a road or a railway line, of communication or of an energy network. I do not think anybody, including the Adaptation Sub-Committee, has started to go into that.

Q200 Chair: Should it be the Adaptation Sub-Committee doing that?

Allen Creedy: I am not sure. One of the questions we asked our members was, "Would you be prepared to act as a community resilience hub?" without defining what that was. But there was a willingness: 40% of our members said, "We will help. We will work locally to put in place the mechanisms and the measures to try to make our community and local businesses more resilient." So what we are pointing towards is a need not only for investment in maintenance and new infrastructure, but for investment in the systems around enabling people to adapt to changes in that infrastructure.

Q201 Martin Caton: At this time, how big is the impact of climate-related network disruptions on the economy, and how do you see that changing in the future?

Brian Smith: I will answer, to start off, with what others are thinking. When we were asking that question, one of the things that we found is that there was not as much evidence about the impact on the economy as we might have expected. We asked at the local authority level and one of the things we discovered was that there was not that knowledge about it and we made a recommendation about working with the local enterprise partnerships as well to try to tease that out.

If you move to the Highways Agency, it would have some higher level figures, but it would need some economist, probably somewhere in the Westminster village, to try to work out how they impact on the economy in the great scheme of things. I think it would be a lot easier—this, in a way, is partly moving over to Tony—if there was a knock-on effect in the energy sector and you could then work it much more clearly from there. Having started, I will stop at that point.

Tony Glover: Critical to this—I come back to the fact we are economically regulated by Ofgem—is that Ofgem has been involved in all the discussions in the preparation of our technical report standards, the work that we have been doing with the Climate Change Committee and so on. That goes to the very nub of it—looking at what are the economic impacts and what is the cost-benefit analysis. At the end of the day, what are the customers, whether it be Allen's small business customers or the domestic customer, prepared to pay in order to ensure the energy network, in this case, is resilient to the standard they expect against the risk they may face in losing the service for a period. In

that sense—I come back to what I said at the beginning—there is the difference between weather events and climate change adaptation, and the challenge is the extra and additional challenges we face going forward.

Coming back to what Allen was saying earlier and was being discussed earlier about thinking forward, the Energy Networks Association is working with the Met Office and Environment Agency and looking out to at least the end of this century. Primarily at the moment, in terms of climate change adaptation, we see flooding as the main risk that we face, and that we are dealing with and have dealt with accordingly, and the latest electricity price control review, which runs until 2023 takes account of that. The investment has been agreed across our energy network companies to address that because of the economic impact as well as the societal impact.

There are other challenges that we are looking at. At the moment we do not understand if there are any wind impacts—increases in velocity of winds; wind speeds—due to climate change over the next few decades and in the next century, but we have commissioned work, along with our member companies and Newcastle University, to look at that very area. There are other issues. Subsidence is another one. There are various areas that we are looking at going forward. We are not being complacent about these things and we are not sitting back and saying, "Oh good, the Adaptation Sub-Committee says we are doing okay so we are all right," because there are lots of other implications and things that are emerging.

Coming back to your initial point, it is about cost-benefit analysis and because we are economically regulated and because, as many of you will be more than aware, there is a big focus on energy bills, we have to justify our expenditure, and we have to justify it against the costs that will be faced if we do not.

Professor Hall: The largest economic effect of climate change is from flooding and the Environment Agency estimates that on average it costs about £1 billion a year in impact. Obviously it does not arrive steadily. Events like 2007 and last winter had much larger impacts than that. Some interesting aspects with respect to infrastructure are the way in which the indirect impacts scale up as the event gets bigger. Those numbers that I have just quoted mostly come from bottom-up calculations of numbers of houses flooded, but as you get to the most extreme events like we had last winter, you then had a larger scale disruption and knock-on effects via supply chains, as we just heard.

Another interesting economic effect, which is of particular concern to Mr Creedy, is that varied within that are transfer effects from one place to another. In my part of Oxford, a number of businesses were under water for several weeks. The economists would say that business is transferred to other shopkeepers elsewhere, but for those particular businesses that can be extremely damaging and put people out of business.

Q202 Martin Caton: Professor Hall, the Committee is aware of the work the ITRC is doing on modelling economic costs. Do we understand the full range of costs involved when a particular network is disrupted? Is it possible to identify the knock-on costs for other networks, for businesses and for people's wellbeing, or are we not at that stage yet?

Professor Hall: It is work in progress. The bottom-up calculations of impacts are quite well understood. We are working on the knock-on effects but we cannot come up with a full quantification of it at the moment.

Q203 Martin Caton: Mr Creedy, you mentioned in your opening remarks, and you have raised it again, the FSB survey that showed that 60% of small businesses do not have a plan to deal with extreme weather. You have said that one of the problems is awareness. Has the FSB tried to consider a way of improving that situation?

Allen Creedy: This is the work that we are embarking upon now. What we wanted to try to do was to get an evidence base of the awareness and understanding of our members and from that tailor an information campaign, an awareness raising campaign, among our members so that we can better equip them to be resilient towards extreme weather situations. That is something over the course of the next six to nine months. We have been canvassing our members on what kind of support mechanisms and information could best meet their needs. What is coming through loud and clear from them is the fact that it has to be simple, easily understood and capable of being implemented by people who are spending most of their time delivering their business.

A couple of points in terms of the indirect impacts. From our survey on the impact on our members, 32% of them said it is about logistics and 45% said it is people. What we are talking about is the indirect impacts of failure of infrastructure that is impacting on businesses. What we found last winter was that many of our members felt that the Government and infrastructure companies said that the south-west was closed for business. It was not—just one railway line was closed—but the net effect of the media's involvement was, "The south-west is closed for business and therefore don't bother coming." Our members went out of business in their droves because of that campaign. There is an adaptation issue here that needs to be addressed. How do we communicate this not only to the businesses to allow them to adapt, but also reassure members of the public, customers, clients, that they can still transact business, they still can go on holiday and they still can do their business?

Q204 Martin Caton: In a previous session of this inquiry the Environment Agency told us that it was looking at ways of incentivising companies to get involved in partnership funding for defences. Do you think that is something the SME sector would be interested in doing, and if so, how do we get it to do that?

Allen Creedy: It is something we did ask our members about and they were relatively positive about working in partnership with the Environment Agency and with energy and utility infrastructure providers. There was a willingness even to make financial contributions and to assist in design. They were looking for something back, whether that is reductions in premiums or reductions in rates, but there is an appetite among the smaller and micro-business community to work in partnership towards sharing the cost and the burden of infrastructure.

Q205 Mark Lazarowicz**:** It appears that different networks face different disruption risks. A report from the Adaptation Sub-Committee points out that roads are most at risk from flooding, railways from snow and ice, and electricity grids from gales. That is a generalisation, but on a basic point it is fair. How far is there a need for specific strategies from particular sectors, or how far would we benefit from a cross-sector approach being

adopted instead? For example, where roads and rail are running side by side, should the emphasis be on trying to protect them both? Should there be alternative ownership? Is there a case for a bigger cross-sector approach? Possibly Mr Dora in the first instance.

John Dora: Just some thoughts on that. When we start to look at interdependent systems such as energy, information communication and transport networks, one of the things that we ought to do is to map out where things are co-located and might have similar sort of risks attributed to them, such as flooding or wind. It is one of those areas that I think is important. We do not have much work looking at that in many ways. One of the issues I have with it is that we need to assess the vulnerability of a lot of existing infrastructure, and that can be done with modern technology, but with the uncertainties involved it can be rather challenging.

Q206 Mark Lazarowicz: How far is that type of assessment being carried out now? Clearly one cannot assess the entire country, but take road and rail, where they are next to each other. How far is that assessment being undertaken now?

John Dora: Some work the railway industry is doing in a programme called Tracker is looking at risks across the interdependencies within the railway, so it will look at vulnerabilities to individual assets, such as signalling, track or rolling stock. I think that is focused very much on the railway system. Extending that outside the railway to include road or other interconnections is something that has not been embarked on yet. It is something I would like to see going. I think the ITRC has done some work in this area, but it is focused on one or two areas. Maybe Jim can comment.

Professor Hall: Yes, that is right. The work we have done is mapping critical infrastructure hotspots across the whole of England and Wales, where we define a hotspot as being a geographical concentration of infrastructure with large numbers of customers either directly or indirectly dependent on those assets. We have mapped out where those infrastructure hotspots are located across the country.

To come back on your first question, you are absolutely right that not only is each infrastructure vulnerable to different hazards, but it also fails in different ways. We would say it has different failure modes, but the principles by which you calculate the likelihood of those hazard—the likelihood of failure given the hazard—and estimate the consequences are all completely cross-cutting. We would be looking for good practice in taking that approach right the way across different infrastructure sectors to come up with risk estimates that are consistent across sectors in order to be able to prioritise and target resources across different sectors.

Q207 Mark Lazarowicz**:** It is interesting what you are saying about your research on hotspots where there is particular vulnerability. How far has this research been developed? Has much stuff that is relevant been undertaken and has it now had an impact on decisions being taken by regulators and operators?

Professor Hall: Yes. We were asked to do this work by Infrastructure UK, the unit in the Treasury which has been particularly interested in interdependencies between different infrastructure networks and trying to identify where those interdependencies are most important, so this is policy-driven research.

Tony Glover: I think it is also talking about the risks, and as the risks change, the interdependencies and the nature of the risks faced by different networks may change as well. As I said, primarily we have been focused on flooding as an issue. A secondary issue is around tree growth, which we anticipate will increase as we go through the century. We are dealing with those issues and the challenge of tree growth in terms of the impact that can have in bad weather on overhead power lines. Over and above that we need to identify what other risks there may be. I touched on, and it is in the report, the challenge of subsidence. That is something we are talking about at the meeting that is going on today, but it is not something we have focused on for our gas networks or electricity networks, particularly those underground, and the impact that could also have on overhead power lines. If it becomes something that we need to understand as more of a challenge going forward, there may well be parallels with other network providers in how we can deal with that.

We had our last projections from the Met Office going back now to 2009 and it is time for a refresh those so that we can perhaps better understand what may be newer identified risks from climate change that were not identified back then.

Q208 Chair: Who determines how often the Met Office does those updates?

Tony Glover: DEFRA.

Q209 Mark Lazarowicz: On Mr Glover's point about the consideration of subsidence as a possible threat, that is one of many examples where you are never going to be able to make the network fully climate-proof without exorbitant cost—and, indeed, you probably cannot do it because you cannot predict everything. How do you make decisions perhaps in relation to subsidence, and in relation to other threats? What sorts of adaptations are required in particular networks? Is that something you do primarily, or does the regulator have a role or your companies?

Tony Glover: Given the nature of the regulatory framework that we are governed by, it is very much led by business plans. Each gas and electricity network operator will provide a well-justified business plan that Ofgem will either approve or will not, and it will ask for changes to it. It is up to the companies themselves to come up with proposals to address whatever challenges there are. That has certainly been the case with the flooding issue and could be in other areas.

It is for the regulator to approve and for the energy network companies to come up with the proposals, but I also think in order to arm the energy network companies with the information they need to be able to make those investment proposals, which hopefully will be approved by Ofgem, there is a need to understand what those risks are. I think you would apply to something like subsidence the same sort of tests that we applied to flooding with our engineering recommendation in response to the 2007 floods. What you apply is a risk matrix: what is acceptable and what is not acceptable.

Q210 Mark Lazarowicz: Some of you have described the different types of work that is being undertaken to assess the various risks, but how far do we have the right sort of information and understanding to work out the right balance adaptation effort in the right places? We have mentioned the railway case and there are issues of a choice between fortifying the network and in some cases providing more links and greater resilience. That is

true for the road network as well. How far is the information enough to be able to make those choices between, for example, fortification against effects, and just providing greater alternatives or resilience?

John Dora: I am thinking of some of the work that we have going on at present, and one of the recommendations is to adopt that kind of approach. I do not think we have very much in the past thought about new routes, alternative routes or reconfiguring a route. I know Network Rail has been looking at alternative routes between Exeter and Newton Abbot because of the Dawlish problem. I know Network Rail has been looking at raising the track near Oxford at Hinksey where it floods, and I have fairly good knowledge about that area because it used to be on my Environment Agency patch years ago. That sort of approach is the kind of approach that is starting to become embedded in organisations like Network Rail, so it has thought about it at Dawlish and at Oxford. I think that is the sort of thing that will spread through the country.

It will probably have challenges in thinking about alternative routes because of the sheer cost of building an alternative route—land take, design, construction, environmental considerations—but that should be part of the toolkit that our operators use in the longer term to get over some of the adaptation issues that we might have. It could be that the proposals for HS3 could build on a more resilient network for the north. We might want to think about other new lines to cut off areas that are vulnerable. On the other hand, if you start thinking about that, you still have to provide the service for the existing railway, where the existing railway is, so there are some challenges in there. I think that kind of approach, though, is the sort of strategic approach that we really ought to start looking at in earnest across all infrastructure sectors.

Professor Hall: Can I come back on this point before we get to HS3? I think it is an extremely important point. There has been lots of innovation and effort going on within the utility sector in particular, and post-2007 and post-Pitt review in addressing these issues of resilience, but it is still quite difficult to get the big picture. We have been trying to do some research to put together all the evidence related to different infrastructure networks and understand what the overall risk is. I think it would benefit from a more concerted effort to assemble national infrastructure data. Some of that is subject to security concerns or commercial concerns, but there are honest brokers there, such as Ordnance Survey, which is trusted by the utility companies, and a lot more could be done to bring together infrastructure data to help us build up this big picture.

Q211 Mark Lazarowicz: Done by whom? Would that be Government-led in some way?

Professor Hall: In many instances the data exists, so it is a question of putting in place processes by which it can be shared and used.

Q212 Mark Lazarowicz: I am conscious that there are other members who have lots of questions, but my final point is to ask Mr Smith in particular, looking at the experience of the floods on the roads and railways last winter, whether that provided any particular lessons about the balance of different adaptation approaches to use?

Brian Smith: I think the critical issue to recognise is that a railway can have one bit of flooding and the whole network is out. It is a stretch. A road, by definition, has some alternatives—less so perhaps motorways, but there are still junctions there as well. We

were very aware of that as an issue. Building on what John says, if you take the railways where it is a long length that has to be protected, you can do the sort of things he was talking about. Equally there are things that Network Rail is investing in, for instance in protecting its signalling systems. If the signalling system goes down, you have a problem, so the increasing use of axle counters rather than the track circuits to protect the signalling systems are important. They are doing things in adaptation of protecting some of the line-side equipment from extreme heat as well.

I think we will see more and we need to see more, for instance in Network Rail rather than on the Highways Agency and the strategic network. I noticed in the infrastructure chapter of the adaptation report that the impression was given that the Highways Agency takes all these things on board, but it was not clear what it was doing in adaptation terms. I think in a way they are still learning from those issues, but the way they have to deal with it is very different from Network Rail, because you either have a long stretch of rail out, or at least you can manage it in highway terms. They tend to integrate it within their ongoing programme, so for instance when they next come to resurface, they will simply take on a harder resurfacing that will stand up more to extreme temperatures. It is a lot easier in highways terms to integrate in that way.

Q213 Neil Carmichael: Just picking up Mark's general theme, how do you factor in the emergence of new technologies and engineering solutions in assessments of possibilities in the future? Also, how do you steer research and development in those fields? Both of those questions are really quite relevant to some of the answers you have given.

Tony Glover: Yes, I think there is a general point. One of the big challenges that we have as energy networks is to deal with what is clearly going to be a much more electric world as we go through the century, with potentially the doubling and more of electricity demand, coupled with some pretty diverse energy generation sources. We are working on, through the Low Carbon Networks Fund, now part of the regulatory framework under Ofgem, as business as usual, a future networks world where we are looking at various projects and areas to deal with these challenges. These fall square in this area as well. We have a potential here for a win-win because we can deal with the challenges of climate change in terms of energy policy, but we can also deal with the challenges of climate change adaptation within that by making our network far more secure and diverse, moving away from a centralised network to a more decentralised network, and managing our network in a smarter way. The "smart" word is misused sometimes, but it really is about managing that network more effectively.

I absolutely agree, and I think it is part of the climate change adaptation discussion as well as being about the climate change discussion.

Allen Creedy: We surveyed our members last year about energy issues. One of the interesting issues that arose was there is a desire by many small or micro-businesses in remote areas to be more independent of the grid, generating their own heat and power. What they are looking to do wherever possible, if they can generate more than they need, is to sell it to the grid. One of the key impediments that we identified to business resilience in terms of energy and heat generation is the inequitable access to the grid, the excessive pricing, lack of transparency and lack of competition in that area. That is something that we have taken up with the distribution and transmission companies and Ofgem, and some work is being done around that at the moment. The resilience of the grid in remote rural

areas and how we stimulate and support businesses to be more independent is a key issue as we move forward.

Tony Glover: Very briefly on that, because we are working with particularly the DG community as well in that respect, there are some challenges there, I do know that. The charging regime, as I am sure we are all aware, is not something governed by network companies. Connections fall absolutely within some of the big challenges that we face, which I talked about earlier, and there is no easy solution to that. We are at saturation point in our network in parts of the UK. We are going to have to invest in that. That is not just about climate change adaptation. That is about climate change and meeting that challenge. We are fully aware of those issues and we are not complacent about it, but it is a challenge.

Q214 Caroline Lucas: In an earlier session we heard some quite powerful evidence from the TCPA that was criticising the current planning system for new development and housing, basically saying that it is on the wrong scale and over the wrong timespan. How do you respond to that kind of analysis when it comes to transport and energy networks? Is planning for adaptation on the right scale?

Tony Glover: Yes. Forgive me coming back in again. We cannot as energy network providers decide where new communities are going to be built, so we cannot control that.

Q215 Caroline Lucas: Do you have any influence over it?

Tony Glover: That is the point. One of the issues is that we would like to see a more joined-up approach about that. What we have seen, and certainly we saw evidence of this last winter, was the impact that flooding has on the whole of the local energy system and the fact that people were off power. As I said, I was on national TV and radio, and having to speak to people online, talking about the fact that they had been off for the whole of Christmas. Some of those people were off and were demanding to go back on power, but they were completely submerged in water. The reality is certainly that if you build in floodplains and then those places flood, people will not be put back on power until it is safe to do so.

Q216 Caroline Lucas: Do you have some influence at that planning stage to say that this is unfortunate?

Tony Glover: We have no more influence than anyone else, frankly—any member of the public. We do not have any influence.

Q217 Caroline Lucas: Anything else on scale from anyone else?

Brian Smith: I will pick up one point. I am very conscious of the issue of runoff that came through last year. It is a broader issue. It affected a lot of the transport network. Rail suffered from it, and there were certainly issues with the Highways Agency with lots of local roads because there were particularly high groundwater levels. It comes down to local planning about getting sustainable drainage systems in place. What we are doing is allowing the problem to get worse for the future, so it does seem to me rather bizarre that we are still building lots of homes—not necessarily in floodplains, because I think we have become better there—but we are not addressing something that we know is

contributing to the problem. I think to get a move on the sustainable drainage systems regulation is really important.

John Dora: Picking up on the planning system, it is an example of an activity that is in a silo and it does not look systemically at vulnerabilities. There is some good stuff in the planning system about floodplains. When you think about the evolution of a flood, from heavy rainfall through to the surface water problems that are sometimes caused by poor drainage or no drainage, and then into the river system, with river floodplains flooding, and then weeks or months later groundwater flooding, and we think of the flooding evolution and identify what might be vulnerable, it might put a different slant on the planning system.

Q218 Caroline Lucas: So it is more of a systems approach?

John Dora: Yes, a systems approach, which is in the NAP, which is something the UK Regulators Network is looking at, and that is the sort of thing that I think is quite valuable.

Allen Creedy: Again, to demonstrate the commitment of small businesses and recognition of the role that we have in this, many of our members in the York area have made financial contributions to tree planting in the dales in Yorkshire, which is being put in place to hold back the water as part of the water catchment planning, trying to relieve the flooding on York. Your word was "holistic", but it is something that is a whole-systems approach. It is having the Environment Agency in that situation helping all stakeholders to understand how they can contribute to finding the solutions.

Q219 Caroline Lucas: Going back to the energy networks for just a moment, I wondered whether you think that there is enough emphasis on looking at the climate resilience of the energy network from the start. What I am thinking of here is that we are going down a road, for example, of building lots of nuclear power stations, which by their nature are pretty centralised. They tend to be quite often in relatively vulnerable areas because they are on the coast, because they want lots of water, but by implication that also means there is potential vulnerability over time if there is a sea level rise or indeed water shortages. Do you think we should be spending more time looking at building in that climate resilience and perhaps coming to a different conclusion about the way our energy infrastructure would look? It might be less centralised and more focused on decentralised energy, for example.

Tony Glover: The first thing to say is that we are required to connect whatever is applied to go on the system, so we are in that sense technology-neutral. We will connect what we need to connect. That is one of the reasons why I said we have a lot of diverse generation sources, because we are going to have to balance—indeed, we already are beginning to have to balance—a centralised system with a much more decentralised system. We have to operate two at the same time. We are going to have distribution network operators becoming mini national grids around the UK, managing smartly, balancing in a local area the generation sources. That is already happening, whether you have to integrate new onshore wind with gas turbines, or indeed nuclear, going forward. I think that is happening already. We have to connect whatever we have to connect.

Q220 Caroline Lucas: You also have a view and presumably an advocacy role that you could be using if from your perspective right at the heart of things you were able to say, "Hang on a minute".

Tony Glover: The transmission network that connects into new-build nuclear is going to be and is extremely resilient. The transmission network is extremely resilient. It is 99.99% reliable. It is not impacted by practically anything that can be thrown at it. We are primarily looking at the distribution networks where there are vulnerabilities. I take the point you are making, but I would say in connecting up new nuclear or new offshore wind, whatever it be, which also will come in from the coast, that we will do everything that we can within the requirements of the regulation that we are faced with to ensure that that is as resilient as possible. Those in the nuclear industry would confirm it is built to be very resilient.

Q221 Caroline Lucas: Nuclear was an example. The bigger point I was trying to make was whether or not local micro-generation of decentralised energy, which by its definition is probably likely on the whole to be more client resilient, is being overlooked?

Professor Hall: As a matter of principle, a system that is distributed, all other things being equal, will be more resilient. So the question then is if the choice is to go down a route with large nuclear reactors, for example, how much needs to be spent in the way that Mr Glover has been saying to protect them against rising sea levels, to provide enough transmission link so there is redundancy, and to build those transmission links to a high enough reliability that the system is very reliable? It really boils down to a cost-benefit trade-off, and those issues around connectivity and resilience need to be taken into account in the cost-benefit analysis.

Q222 Caroline Lucas**:** I suppose my question is simply whether it is the responsibility of any of you in the different roles that you play to be raising that perhaps more loudly with Government than you might be? Do you feel that is your responsibility? I get the sense at the moment that decisions are made and for those of you on the front line of networks your job is just to connect whatever gets asked to be built, rather than feeding back to Government and saying that if climate is this overwhelming priority and urgency, that might feed into some of the earlier decisions.

Tony Glover: The clearest guidance we can get is from you, from Government and from legislators about the direction you want us to go in, and then we can plan accordingly. From an energy network's point of view, being able to plan forward is something we would want to do, particularly in the context of climate change adaptation, but it is not for us to say, "We think this would be a better option than that." That is not our role, certainly not from the energy networks' point of view.

John Dora: The Infrastructure Operators' Adaptation Forum does have licence to try to influence decisions, but we try to base our comments or our inputs along the lines of the evidence we have. I am thinking about nuclear power stations as an example: what sort of design life might they have—30, 50 years? How much sea level rise might we be impacted by? Maybe not that much. We are not looking at something that is going to last 150, 200 years.

Q223 Caroline Lucas: But there are some suggestions that even by the end of the century we could be looking at two metres of sea level rise.

John Dora: That is a good one for engineers because if you give a problem like that to engineers, they can go and solve it. They can spend money on it and they solve it. They

can design out the risk that way. It might cost a bit more, but having certainty over some design criteria there is quite important, as is having the data. It comes back to the asset life that we are building or the component life within a system that we are building, and how much might it be impacted by future climate change.

Q224 Caroline Lucas: How far ahead are network providers planning their infrastructure needs, and is that far enough ahead to force them to take the needs of adaptation into account? Again, this has come back from the TCPA saying that they thought that the time periods we should be looking at are 50 and 100 years, hence from the perspective you have of network providers.

John Dora: I have seen some work in the railway industry looking to the 2040s and 2050s, and some projections suggesting that, down at Dawlish again, they might need four tracks for growth in traffic. You then start to question the basis of how these projections are made, which is another issue altogether. They are looking with a long-term view at growth in traffic over the next 30 and 40 years in the rail industry.

Q225 Caroline Lucas: Is that enough?

John Dora: It is probably something that people are comfortable with. It might not be enough.

Caroline Lucas: That is a different question.

John Dora: With all the uncertainties, because they will be taking account of things like projections and demographic change and growth in population, which other Government Departments and bodies have made up to the 2050s, there is a lot of other change to take into account, as well as adaptation and changing climate. I am an advocate for looking at other things that might change over the next 20 or 30 years that we can build into any arguments that suggest we want to increase resilience, increase redundancy or make things more adaptable.

Q226 Caroline Lucas: My last question was the extent to which relevant Government Departments are co-ordinating their work when it comes to adaptation issues that cut across responsibilities. I am thinking of the fact, for example, that DECC has energy responsibilities and DEFRA has flood responsibilities, with DfT responsible for transport networks, BIS for business needs and DCLG for local authorities. From the perspective you have, do you feel that there is a sufficient co-ordination between the different Government Departments that are responsible for these different area?

Chair: Silence.

Professor Hall: There are a number of mechanisms in place to assist with that co-ordination. John's Infrastructure Operators' Adaptation Forum is one of them, the Cabinet Office Infrastructure Security and Resilience Forum is another place where people with an interest in infrastructure resilience get together, and the recently configured UK Regulators Network is another mechanism by which these cross-sectoral issues are being addressed within Government.

Brian Smith: Perhaps I can add to that as well. I have also seen the DfT response to the resilience review we did, which came out in November; that certainly flagged up a number

of areas where there needed to be further work across Government Departments. We have referenced already the issue of critical networks. That is a point that has come out where it is really important to work across Government Departments in identifying those networks. So it is moving forward definitely, but I suspect, like most of these things, that you can always do more.

Tony Glover: Critical to that is the UK Regulators Network, which is something we certainly strongly support.

Allen Creedy: We have expressed concern to Ofgem, Ofwat and Ofcom about their failure to take into account the interests of small and micro-businesses as they appraise the business plans—whether that is PR14 for Ofwat, whether it is the distribution and transmission companies—the lack of attention to the interests of small and micro-businesses, and our dependency on those utilities and what happens in the event of a failure. So it is the absence of contingency planning that takes into account small and micro-businesses. Responding to your question about is there co-ordination, each of those regulators approaches it very differently so it would not seem obvious that there is co-ordination.

Caroline Lucas: That is helpful, thank you.

Q227 Peter Aldous: I have a specific question to Mr Creedy. As a result of last year's storms, the Government did come up with resilience grants of, I think, £5,000 for properties that were affected. Were your members who were eligible properly made aware of that opportunity and what sort of take-up has there been?

Allen Creedy: We have carried out a specific series of initiatives in the Surrey and Somerset areas where we have put additional staff on the ground to make our members aware of the availability of those grants. We have done that, we have paid for it and that has increased the uptake of those grants. Had we not done that, I do not think those grants would have been taken up to the same extent. A fairly straightforward answer.

I can come back to you with some figures on the number of our members who have taken up those grants. I do not have those to hand.

Peter Aldous: Thank you. It would be helpful if you could.

Q228 Dr Whitehead: The Adaptation Sub-Committee report that we had mention of earlier in our proceedings has this to say about infrastructure preparing for climate change: "Infrastructure assets and networks are complex, long-lived systems that are exposed to natural hazards. Decisions on the renewal of existing infrastructure and on the design and location of new infrastructure should account for projected changes in climate over the lifetime of the asset, as this is likely to be cheaper than retrofitting or bearing the costs of damages in the future. For some assets, lifetimes can be up to 100 years or more." That is, in a sense, the guidance, but it is a bit more difficult than that, isn't it, in terms of the eventual elision, say, of extreme weather circumstances into a pattern that is then climate should the projected changes in climate over the next period come to pass? Is there sufficient certainty that that is clear to infrastructure developers and developments to enable that sort of lifetime

investment to properly take place, or are there disincentives to making that happen? I can see circumstances where everyone will say, "No, it is not us, it is them." There may be more extreme weather patterns, but those in themselves are not enough for us to get going on this 100-year upfront investment in climate resilience that is clearly required by those changes.

Tony Glover: Just coming in from the energy networks' point of view, the big threats we face are not in terms of the infrastructure itself. Generally speaking, they are the impacts of other things on the infrastructure. If I take the example of debris—trees falling over—and the impact that has and did dramatically have last winter; that is an issue of how we manage the environment around us, around our infrastructure. One of the things that we are looking at, because there clearly are some implications whether there are increases in wind speed or not, is that we are anticipating increased growth of vegetation around our infrastructure, but also the implication of increased water saturation around trees and increased wind speeds. You add two different types of weather together and what you get is trees flying over, hitting overhead power lines and taking out communities. So there is that; that is something for us.

In terms of our infrastructure itself and protecting substations primarily from flooding, as the Adaptation Sub-Committee report has pointed out, we are addressing now where we perceive that to be and where we have been told the high risk areas are—the hotspots. So that is something that is going on.

For future challenges, I talked earlier about subsidence as something where we do need further work. As I said, the University of Newcastle has been commissioned to look at potential within climate change for increased wind speeds: if that is going to be a factor, what impact is that going to have? But it is very much about externals not the infrastructure itself. Our infrastructure is built to international standards. It can take higher temperatures and colder temperatures than any bit of the UK can throw at it and is designed to deal with some pretty difficult challenging scenarios. A lot of it does last for over 100 years, so it shows you how long-lasting it is.

Professor Hall: If I might just try to understand your question more precisely, I think there are potentially two angles to it. The first is, "Is the information good enough to design on that length of timescale?" and the second is, "Are infrastructure owners and operators incentivised to take the long term into account?" Which of those were you getting at?

Q229 Dr Whitehead: Both. In a sense one follows the other in as much as if you are designing a piece of infrastructure that is supposed to last 100 years and you may think then that the circumstances under which the resilience has to be built in are not sufficiently certain for you perhaps to incur a very large amount of upfront additional costs and design, for example, and build, you may not go down that route. Unless there may be incentives or disincentives to go down that route, you might indeed produce a whole generation of new infrastructure that is not fit for purpose. We are hearing just now that alarmingly or interestingly our entire rail network appears to be built on embankments about which we have no idea whether or not they are going to fall over in the next period.

Professor Hall: On the first of those points is a question of how we make decisions under uncertainty for long-lived assets. There are two approaches: precautionarity, building things bigger, or flexibility, so putting in the room to change things should the future turn

out to be different to what is projected. Again, that comes down to a cost-benefit trade-off. The trade-off then is how large are the uncertainties and so how might we be spending a bit more upfront in order to provide that flexibility to adapt in future, or should we be placing our bets now and building something big enough at the moment? The principles of that are well established and there are some examples of that being done in the context of flood defence design, for example.

On the second question of whether infrastructure owners and operators are incentivised, that comes down to the regulatory process, the use of design standards and where infrastructure designers are getting their climate change evidence from. In the sectors that we have looked at, good practice is taking place in that people are looking to try to get hold of the best climate information they can and are observing design standards. There is, I think, an issue around looking to the long term, and it comes back to the question of whether operators are reporting accurately on the risks to which they are exposed and expect to be exposed in the future. That is why reporting is so important because it incentivises people to demonstrate that they are getting it right in the long term.

Q230 Dr Whitehead: To give you a specific example about incentives, or you might say reverse incentives, this is something cited by the Adaptation Sub-Committee report. If Network Rail misses its performance target during a period of severe weather, the Office of Rail Regulation will then substitute days when that severe weather occurs with an average day for the time of year as if that severe weather had not occurred in terms of any penalties that may fall upon Network Rail. Similar severe weather events are exempted by Ofwat's minimum guaranteed standards. Ofgem's interruption incentive scheme does not include extreme weather events. They are classified as extreme weather events and are removed from any incentive process. Presumably as those become more common, that approach seems to be very clearly a disincentive rather than an incentive. Perhaps one might say—Tony might baulk at this—remove the exemption on severe weather as a penalty from the regulators.

Brian Smith: If I just pick up that specific point, yes, there are issues like that within the existing regulatory framework. Indeed, added to that, and one of the things that we picked up in the review, is that you have the signals going to Network Rail, but what is happening to the train operators because you have different signals going to them as well? One of the things we would say is absolutely vital for the future is that you are economically bringing up the signals together in what you are doing. For instance, we have heard quite a lot about striking trees, and we heard all about that last year. There was a lot of damage to train sets and the carriages as well. That had a real knock-on effect to passengers as those carriages had to be repaired.

You are absolutely right that what the extreme weather has thrown up sometimes is the fact that the incentive system is not quite right. The nature of regulation is that it does not just change overnight but I think what we are seeing is it changing within the regulatory period. It then comes right back to—and we have said it several times this afternoon—the regulatory role, whether it is Network Rail, or in future it is going to be the regulation of the Highways Agency or indeed of the energy industry. Absolutely vital are the signals it sends out and then the behaviours and the decision making that follow from there.

Tony Glover: Just answering the point there, the reality is if people are off supply for over 24 hours, there are massive penalties. They have increased since last winter. The maximum is £700, which is a multiple above what each domestic bill payer pays for their

network. There is an incentive there, apart from the fact that energy network operators do not want people to be off power and do not want people to be off supply; they are part of the communities that they work in. There is that incentive and any of the people on the line who are facing the potential for a problem this very weekend will want to work as hard as they can to ensure that people are not off supply. So there is definitely an incentive there.

What is driving the incentives? As Jim has said, we have been working with our regulator on climate change adaptation and the things that our networks need to do in order to address that, based on the information that we are given, going back now to 2007. We have been working with the regulator very closely on that. The regulator has fully understood the processes as they have gone forward. That has meant, when we come to a price control review and we present business plans that say we need to do this—and this is based on a reporting process as set out under the Climate Change Act—we are going to have to do these things. Ofgem understands and will accept that, and in fact will expect us to be able to deliver that, although there is no specific climate change adaptation incentive. Not being complacent, I would say that we are in a pretty good place in relation to that. It is critical that all the economic regulators are in that place. It is critical that the UK Regulators Network, something we have been working with since its inception, does deliver on this across the economic regulators. I think in our sector, as reflected in the Adaptation Sub-Committee report, we are delivering, and perhaps there is some learning for other economic regulators.

Q231 Simon Wright: The Adaptation Sub-Committee report suggests that the UK market for adaptation goods and services is undeveloped, with UK growth lagging behind the growth in adaptation sales among overseas competitors. What is hampering growth in this market?

Chair: Anybody? Is nothing hampering growth?

Simon Wright: Is growth being hampered, or are there more Government actions that can be taken to support and accelerate growth in this sector?

Chair: Is a matter of concern the advantages there could be for UK business on this? Is this a market we need to be getting into?

Tony Glover: From our perspective, since the floods in 2007, there is the technology we need to protect our substations, given the criticality, and going back to Walham, neighbouring Mr Carmichael's constituency, where the impact was potentially massive. We have developed technology with suppliers on that, but that is something that has happened because we demanded it. I do not think we are being hampered in any way. From our perspective—I have to be honest—that is not an issue that I know in the energy network sector.

Q232 Chair: Are there opportunities for your small businesses, Mr Creedy?

Allen Creedy: Just to comment on this situation, we have been involved with Ofgem and the distribution and transmission companies in looking at their plans for adaptation. Coming out of that partnership has been quite a number of opportunities where Ofgem have incentivised the distribution and transmission companies to innovate with new

products and new services around resilience of the network. We have been able to make our members aware of that. There are a significant number of small and micro-businesses in the UK who are now in that sector and are innovating around technology. It is a growth area. BIS recently set up a series of overseas trade missions for that technology and those products and services to be showcased abroad. It is an area where there is work taking place and British business is stepping into that niche. I do not think it is well understood or catalogued, and I do not think its value is particularly well understood. It may be an area where some more work is required.

Q233 Simon Wright: Is that something that can be done through work with the local enterprise partnerships? I think Climate UK is working to raise awareness and support best practice, but do you think there is more that could be done in those sorts of working practices?

Allen Creedy: There is a price mechanism and there is an incentive mechanism through the regulators, and you could perhaps bounce it back to the regulators and they could ask the distribution companies and telecommunication companies to bring forward some evidence of the way in which small and micro-businesses are being involved in this innovation area.

Tony Glover: Can I just add on that particular point of low-carbon networks innovation? We run a conference every year and we had about 1,000 people last year in Aberdeen. Basically everybody is invited; it is a free to attend conference to talk about the kind of technologies that we need to develop to address smart climate change, climate change adaptation, resilience—all these areas. One of the really critical things about low-carbon network innovation from an electricity and gas network operator's point of view is that third parties are involved and suppliers are involved—we have academia; there are partnerships. There is a network innovation competition and as part of that you have third parties involved, so there is an opportunity for developers of new technology to be part of it. That is something very exciting in our sector and, as Allen has said, that does incorporate climate change adaptation as well.

Allen Creedy: I think that would be replicated in the other regulated activities, both Ofcom and Ofwat. As we move to market liberalisation in the water sector, there is a lot of innovation taking place in the retail markets. I think there is some good practice in the energy markets that could be cascaded out.

Q234 Peter Aldous: It strikes me that some of the places most vulnerable to the effects of climate change are not in this country. With that in mind, do you think there is a role for DFID in highlighting these business opportunities for companies?

Allen Creedy: Some of our members have been involved with DFID in developing solar lanterns, for example, and some of the smart technologies associated with wireless and smartphones. So I think there is an opportunity there through DFID to stimulate small and micro-businesses and support them, whether it is export guarantees or whatever.

Professor Hall: An important aspect of these adaptation business opportunities, and adaptation goods and services, is around the engineering and multidisciplinary consultancy firms in the UK. The UK is regarded for much of what it has done in adaptation via the Climate Change Act and so on, and some of that recognition, for example, comes through what the OECD has written on the UK's adaptation activity. In a sense, the OECD has

been advertising some of what has been going on in the UK and the consultancy firms have an opportunity to follow through with that. There are some very interesting things going on within those firms. I think this does touch on the broader issue around engineering, science, economics, skills and availability to provide the expert staff who are needed to grow that business within the consultancy sector.

John Dora: Jim has helpfully set out most of what I was thinking about. He must be reading my mind. I am very aware of many consultancies who are involved abroad in bringing technology to some vulnerable countries and some well-developed countries as well. But I think the issue is about skills capacity and knowledge. One or two very large consultancies I have been working with have maybe two or three people working on adaptation and that is the sum total of the sort of expertise that is around. There are not many people who are experts in adaptation. They had a telephone conference on development of international standards of adaptation—I am part of an ISO group looking at adaptation standards—and we are thinking that we will have to look very hard to get those technical experts on adaptation globally because there are not many of us.

Q235 Simon Wright: Mr Glover spoke earlier of some mini national grids and decentralised networks in response to Caroline Lucas's question. How might society have to change in other ways to respond to greater network distribution risks? For example, could working patterns change to avoid or reduce the need for travel?

Tony Glover: This is an interesting area for network companies because historically it has been centralised and the relationship with the customer has been minimal other than when they lose power. That is radically changing and some of the projects under the Low Carbon Networks Fund that I have alluded to are looking at customer behaviour and how customers can manage their own behaviour in terms of energy usage in a way that maximises the capacity of the network, given the challenges we are talking about. That could be a whole range of different things.

The simple answer to your question is there absolutely is behavioural change at the heart of managing the future network and that is something that network companies traditionally have not been involved in at all, but are now involved with. It is the key, I think, to some of the network challenges that we face, whether that be, as you say, people working at home or whether it be the patterns of use of hot water and when we do the normal things we do. Given that we could well see ourselves with a future of greater electrical heat but also electrification of transport, we are going to have to manage that challenge. People have been brought up in a world where they can just go to the pump and fill up. That is going to have to change. We are going to have to think about how we can manage the network in a way that it does not fall over when there is this demand on the network to charge up cars. So it is at the heart, yes.

Chair: We have reached the end of our session this afternoon. I think it was Mr Dora who mentioned just now that there are not many people who are expert on adaptation. We have had a fairly expert panel in front of us this afternoon, so I thank each of you for coming along. Thank you all very much indeed.