



Energy and Climate Change Committee

Oral evidence: [Heat](#), HC 743

Tuesday 12 November 2013

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Written evidence from witnesses:

- [National Grid](#)
- [BEAMA](#)
- [Mitsubishi Electric UK](#)
- [Ground Source Heat Pump Association](#)
- [Mineral Products Association](#)
- [Calor Gas Ltd](#)
- [Solid Fuel Association](#)
- [Mike Mason](#)

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Members present: Sir Robert Smith (Chair); Dan Byles; Albert Owen; Christopher Pincher; Graham Stringer; Dr Alan Whitehead

Questions 74-149

Witnesses: **Marcus Stewart**, Energy Demand Manager, National Grid, **Kelly Butler**, Marketing Director, BEAMA, **Donald Daw**, Divisional Commercial Director, Mitsubishi Electric UK, **Chris Davidson**, Chair of Policy Development Committee, Ground Source Heat Pump Association, **Dr Richard Leese**, Director, Mineral Products Association, **Paul Blacklock**, Head of Corporate Affairs, Calor Gas Ltd, **Jim Lambeth**, General Manager, Solid Fuel Association, and **Mike Mason**, DPhil Researcher, University of Oxford.

Examination of Witnesses

Witnesses: **Marcus Stewart**, Energy Demand Manager, National Grid, **Kelly Butler**, Marketing Director, BEAMA, **Donald Daw**, Divisional Commercial Director, Mitsubishi Electric UK, and **Chris Davidson**, Chair of Policy Development Committee, Ground Source Heat Pump Association, gave evidence.

Q74 Chair: Thank you very much for coming to give evidence on our heat inquiry. For the record, could you introduce yourselves, starting on my left, with your name and organisation?

Donald Daw: Chairman, my name is Donald Daw from Mitsubishi Electric. We are a manufacturer of heat pumps.

Marcus Stewart: Marcus Stewart from National Grid.

Kelly Butler: Kelly Butler from BEAMA. We are a trade association. We look after manufacturers of heat pumps, heating controls and various other heat-related products.

Chris Davidson: Chris Davidson. My day job is a director of GI Energy. We do large-scale ground source heat pumps in the UK; I will stress we do systems not just boxes. Today, I am representing the Ground Source Heat Pump Association, where I chair the Policy Development Committee.

Q75 Chair: As I say, thanks very much. A number of pieces of written evidence handed in have suggested that there needs to be a system approach to tackling heat. In your opening remarks, could you say what you think a systems approach would look like?

Donald Daw: I am happy to go first. The change that we are going to undergo in heating, particularly the change in the whole system approach, recognises that, even though we are a manufacturer of heat pumps, there is no one solution for everything. Particularly the thermal improvement of properties will have as big an impact on the reduction of energy and therefore carbon emissions of heat, as would the change in the technologies; those two things need to go hand in hand. Probably, the organisation and systems required for the early change in off-gas grid is something that will happen before we see a change in the on-gas grid.

Marcus Stewart: From National Grid's perspective, we look at the wider energy system, the electricity networks and the gas networks, and in order to meet the heat decarbonisation targets, we need to consider the energy trilemma: security, affordability and sustainability. From a systems point of view, we need to look at not only where we are trying to get to, but where we are starting from as well. It is making the best use of the existing assets in the UK. We have the most extensive gas network in Europe. We have a significant electricity system as well. It is looking at when is the right time to move heat demand from the gas system to the electricity system, when power is decarbonised, what are the full system costs in terms of generation, network costs and also the impact on consumers. From our perspective, that is a system. You need to look at all those points, try to understand and go down an optimal pathway.

Kelly Butler: Similar to Marcus really. We look at systems in two different ways. Firstly, within the dwelling or the building, you can't disaggregate a heat system and look at an individual component and think that you have done a job. Replacing a boiler, for example, will obviously increase your heat generator efficiency, but if you don't treat the radiator system then you are probably losing about 15% of efficiency there over time. We have some very new research and information that shows that, if you do not have controls, you are losing about 40% efficiency in your heat system. These are the kind of things that we should be doing within the building, looking at the system in the round.

The extended system or the macro-system, of course, is the relationship with the grid. From our perspective, there is a critical path here that I can't quite see at the moment. We talk a lot about smart grids and the interaction with electric storage and heat pumps and demand response management, but that is all predicated on time-of-use tariffs and the actual operability and being able to switch loads further back into the system. What we are interested in now is the timescale over which that is going to happen and what the plan is to get there.

Chris Davidson: From our point of view in the Ground Source Heat Pump Association, while we represent primarily that technology, it cannot be taken in isolation. It is critically important that it interacts with the grid. If we deploy heat pumps incorrectly in the UK then we will suck up an awful lot of electrical generation capacity in a non-thinking way, whereas if we apply the technology properly—and, as Kelly said earlier, controls are the absolute heart of that—so when we as a company, not so much the Ground Source Heat Pump Association now, look at a system, we do look at it in the round. We look at integrating with other technologies and making sure that that whole system works in the lowest possible energy way.

Q76 Chair: On the controls, are there a lot of dwellings where there are no controls as at the moment?

Kelly Butler: There are 8 million homes without a room thermostat and 9 million homes without a thermostatic radiator in the house. We did some work and looked at the cost of a home without controls per year and it would reduce the cost of heating by 40% if you were to put in a room thermostat and TRVs. The barrier to this is consumer education and knowledge of what the benefits of controls are—supply education as well and installers having not so much the competency but the faith to be able to sell these to customers.

Chris Davidson: I think the situation is even more difficult in commercial buildings, where there has been a legacy of poorly installed and installed in isolation systems. These now need to be integrated. We are seeing huge benefits in integrating the control systems, understanding that commercial buildings need to be heated and cooled. For that to be done in the most energy efficient way possible, it is necessary to have controls at the heart of it.

Q77 Albert Owen: Can I move on to the domestic energy policies themselves? As you know, the Government has three main policies to reduce the environmental and economic impacts of domestic heating: ECO, the Renewal Heat Incentive and the Green Deal. How well do you think these are meeting the challenge of heating from both a cost and emissions perspective?

Chris Davidson: At the moment, in the marketplace commercially, we are finding that certainly in our core technology of ground source heat pumps there have been some serious implementation issues with the commercial RHI. That has meant that the technology that I represent particularly has been disadvantaged from both a tariff point of view and a complexity point of view. There are complexities in ground source heat pumps that do not exist in other technologies, particularly around heating and cooling. We have had to spend an awful lot of time with DECC, and I have to say the people at DECC have been incredibly supportive. It has been frustrating and it has taken a long time, but we now see the policy documents, which should come out very soon, leveraging the technology.

As far as ECO and Green Deal are concerned, it is early days. I think there is a lot of confusion in the marketplace. There is poor understanding out there. It is improving, but it needs to improve more quickly.

Kelly Butler: As Chris has said, it is very early days, but ECO is built on a very successful model of energy supplier obligations going back about 20 years, right the way back to the previous Conservative administration. It is a programme methodology, and I think energy suppliers are right to have that obligation. What we are seeing at the moment is most of the activity appears to be in loft insulation, cavity wall insulation and boilers, which is probably right—insulate before you heat.

The issue for the supply chain is that the way ECO runs out, it is very difficult to predict at what point energy suppliers are going to tackle different elements of the obligation that has been laid down. It is quite hard to gear up for something like that because you do not know when they are going to step in, move away from affordable warmth and into other areas, and it is a complex programme. I know that some of the administration on the CSCO, the CERO and the Green Deal are causing some issues.

I would say the Green Deal is having very little impact on our bit of the supply chain. There are not many controls going in. I don't know why there are Green Deal packages being approved with no controls. It would seem daft to insulate a dwelling and then not control the heat, and I think that is down to the methodology for calculating the Green Deal, which is SAP. We can have a three-hour conversation about that one day, but that is a flawed model. For heat pumps as well, there just does not seem to be enough relationship between the RHI, the Green Deal and ECO to push heat pumps in the way that I think they should be.

It is quite early days for the Green Deal and ECO, but I think there are going to have to be some changes, certainly in the way the modelling works, if we are going to see any growth in heat pumps and controls.

Marcus Stewart: The policies that worked to date have been around supporting insulation but also legislation around condensing boilers. We have seen on the gas network about 30 TWh of demand reduction from insulation and around 30 TWh from condensing boilers. We believe there is probably another 40 TWh of each to go, and in our scenarios we are saying that with the right policies in place those demand reductions, and therefore carbon reductions, can still continue.

The RHI, particularly the domestic RHI, has been delayed a number of years. We are hopeful that will start to improve the take-up of air source heat pumps on off-grid

properties. That is what it has been designed to do, and from the numbers we have run, it looks like that should work, but it is still early days. In terms of the Green Deal, I think I echo what Kelly has said. We are still quite uncertain about how that is going to work and we are looking at the evidence.

Q78 Albert Owen: For what period are the reduction figures that you have just given?

Marcus Stewart: That is from about 2005. We have seen a steady reduction in gas demand since condensing boilers came in and that is a combination of the boilers—about 1.5 million boilers are replaced each year, so you are getting that regular churn—and the insulation that has gone in at the same time.

Donald Daw: I think Green Deal uptake has been much slower than anyone would have anticipated in the early scenarios. I personally put that down to the discomfort of people considering taking on debt, even though that debt is more related to the property than the home. I think it is a psychological barrier to be overcome there, whereas before you could get many of those measures virtually free from a utility.

With regard to RHI, commercially in the ground source area, we have started to see more interest in large domestic applications of multiple-tenanted dwellings as well as in commercial applications for standard office buildings and the like. It is very early to say for domestic RHI because the policy has only just been announced. We are running a series of seminars now with our approved installer network and the latest feedback we had in the past few weeks is that inquiry level is up substantially since the RHI has been announced. Whether they convert to orders is yet to be seen, but the initial response from the people working in the industry already is that there is a greater level of interest from individuals, particularly off-gas grid.

Q79 Albert Owen: My crude analysis of what you have said is that ECO is early days—a successful model, but very complicated—and the Green Deal package is flawed. These incentives are there to reduce emissions but also to cut bills in the future. Do you think it will have the desired impact of cutting bills?

Kelly Butler: Given that it is focusing on insulation—about 250,000 measures have gone in of which about 70% are insulation—then for sure it is going to reduce bills. The supply model is a cost effective model and it has been proven, so I don't think there are any issues about that. It is effective.

Q80 Albert Owen: To put you on the spot, Mr Butler, over what period do you think it is going to start reducing bills significantly?

Kelly Butler: What do you mean exactly?

Albert Owen: The desired effect is, as I said, to reduce usage but also to reduce bills. At the moment, we are seeing bills go up considerably for heating and people have had great concerns. Are these going to work in themselves? Are we going to iron out the flaws and smooth everything and people are going to adapt to them and we are going to see reduced bills for households?

Kelly Butler: Where the measures have gone in, yes.

Chris Davidson: I think it is fair to say, though, that the fuel price changes have a much bigger effect on the current marketplace than many of the measures that are going in under the Green Deal.

Albert Owen: That is not what everybody is telling us now, as you fully understand.

Q81 Chair: Can I ask one follow-up? You said that the ECO is a cost effective approach to delivery. Do you think in the review of levies there is a risk that they could lose that cost-effectiveness, or if it was funded differently it would still be cost-effective?

Kelly Butler: I can't answer that question. I am not entirely sure. Putting the obligation on the energy suppliers and the power on the energy suppliers has to be cost-effective because of the economies of scale and their purchasing power. I think if you try to do this in any other way, in any other procurement model, it is quite difficult, unless you go direct taxation and make it a Government agency funded activity, a bit like HEES or Warm Front, as we have had in the past. Then you may be able to get bulk discounts, but the energy supply model seems to work, an initial way of changing.

Chris Davidson: Yes. I think one of the weaknesses in the energy supply model is that big bureaucratic organisations take some time to get up to speed. I think that is a weakness, and it is very easy for that inertia to take some time to overcome.

Q82 Albert Owen: Just going back to building regulations, do you think they have an important role in reducing demand for heat?

Kelly Butler: They have certainly had an important role in terms of the condensing boiler legislation, and we would quite like to see that being extended over the next 10 years because we are now going to have a label for heat systems. You should be able to label an A+ heat system, which would be a condensing boiler on solar or heat pump.

Certainly, progressive building regulations can make a change in existing buildings. They have been quite effective in reducing emissions on new build, but we are nervous about what appears to be a rollback in our approach to the zero carbon agenda in building regulations. We would have been expecting a far greater increase in reduced emissions and reduced energy consumption in new buildings in this round of regulations. What we have ended up with is 6% and I do not think that is going to do anything to grow much in the way of fabric efficiency and certainly much in the way of renewable heat.

Donald Daw: I think the new build regulations coming in are a lot of softer than they need to be at this point in time, which fully echoes Kelly's comment. I also think the regulations play an important part in the journey linked with RHI. RHI's main purpose is to span the gap for regulation and fuel costs, make the use of these alternative technologies the norm. I think we need a roadmap in place for when RHI transitions to a regulated environment, where we are putting in these efficient, low carbon renewable systems.

Q83 Albert Owen: Would anybody else like to comment on building regulation?

Chris Davidson: I think in the past the planning regulations have been very good for the business. With the onset of the recession and so on, weakening of those planning regulations has affected the marketplace.

Q84 Albert Owen: You take a different view to Mr Butler?

Chris Davidson: Not necessarily different. I certainly agree with Kelly's comments, but I would augment it by saying planning in the past has been very good for us.

Q85 Albert Owen: Over what period are you referring to with the 6%?

Kelly Butler: The way that the building regulations are structured for new build, it is a percentage improvement on the last regulations. The last regulations were 2010, so it is a 6% improvement.

Just another comment on building regulations, if you don't mind: there is quite a lot going on at the moment in terms of consultation and policy decision-making that seems to be quite disconnected. The RHI is supposed to be taking us to a mass-market approach. This A+ labelling and the building regulations should be delivered under an RHI pathway. In new build, we have building regulations now at 6% and we have the Housing Standards Review, which is suggesting getting rid of the Code for Sustainable Homes. We would have said that would probably be a sensible thing to do if the building regulations were going far enough, but now they are not going far enough I am worried about getting rid of at least the ENE1 element of the Code for Sustainable Homes, which is the energy bit.

The review also suggests repealing the Planning and Energy Act, which in effect pushes through the planning process—and I agree with Chris that planning is key here—to have an element of renewables on new build development. If that is repealed, I do not see where the push is going to come from for renewable heat. We are very concerned that we have a department, DECC, over here pushing renewable heat and we have CLG systematically taking that apart. That is a concern for us.

Chris Davidson: If I may add a couple of comments on building regulations. I think one of the key areas that is perhaps being missed at the moment is that SAP, because it is so fundamental to building regulations, must be sophisticated enough to understand systems, as we were talking about earlier. It is not at the moment. It is not sophisticated enough, and in many ways it can be a barrier. I would just make that comment.

Finally, a real conundrum at the heart of the whole building services industry is what is designed is not what tends to be built. Following through the building regulations and ensuring that, as BSRIA's campaign, for example, and Soft Landings and so on shows, even BREEAM Excellent buildings are not achieving the energy efficiency that they are expected to. I think that is critical for our technology, particularly because what we put in the ground is a finite resource.

Q86 Albert Owen: I think you have covered the Code for Sustainable Housing. Can I ask Mr Butler one question that others may comment on? You mentioned the lack of communications between the departments here in Westminster and in England. Do you have

any comparable experiences from Scotland, Wales or Northern Ireland where there is more joined-up thinking there?

Kelly Butler: Not really. I suppose it is a bit of a bone of contention for anyone in manufacturing to have to devise effectively four different marketing campaigns or four different bits of literature to deal with four different—

Q87 Albert Owen: My point was, is there any best practice in the others that you think Westminster, DECC and the Department for Local Government can learn from?

Kelly Butler: Interestingly enough, we had a meeting at DECC last week with some housing providers, and the chap from Dumfries & Galloway Housing Partnership said that one of the things we possibly could learn is that the Scottish housing quality standards seem to be a lot more robust and there seems to be a lot more pressure on social housing providers to improve the standards of their homes than there is down here.

Q88 Albert Owen: The reason I mention that is because I know there is debate in Wales now that they are too high and some of the development companies, building companies and construction companies are saying they are too high.

Kelly Butler: I am very surprised by that because Wales was quite bullish about its pathway to zero carbon in the early days.

Albert Owen: Yes. It is the construction companies I am referring to.

Kelly Butler: Yes.

Q89 Dan Byles: I would like to home in on heat pumps specifically. I remember attending an event at the Energy Saving Trust just over a year ago, following their field trial on heat pumps. I went into that presentation quite positive on heat pumps and I came out horrified to learn that only 13% of the pumps they had looked at in their trial had achieved coefficients of more than 3. Do we have a problem here? It seems to me that there are two issues affecting the COP of heat pumps. It is not only the intrinsic design of the pump itself; there is also the installation. Of course, if we are going to incentivise the installation of these products, we are incentivising them regardless of how well they are installed, because there is nobody coming around checking that they are installed properly before ensuring that somebody receives a subsidy. What would you say to that?

Donald Daw: I am happy to take that first. I am sure Kelly has something to say as well. We were involved in the EST trial as one of the manufacturers. The reality was none of our actual heat pumps were part of the main trial, and I will explain shortly.

Dan Byles: We will get that on record.

Donald Daw: Yes. I will explain why. We started our own monitoring programme prior to the EST programme starting. We have been selling in the UK for about six years and we started a programme with the first heat pump we installed. We have had our own

monitoring programme running for the same period, which is audited by the EST, and a report was published in parallel to that trial. We recognised from the early days that, however good the heat pump was, if it was not installed properly and, more importantly, it was not designed correctly for houses—that is for low-flow temperatures—then it would be impossible to achieve a coefficient performance that was classed as renewable. The EST trials were a little disappointing to the industry, but I think they were based on installation practices that were not fixed within the industry. We now have the MCS programme for both equipment and installers and that is a mandatory part of claiming RHI. You must use MCS-qualified installers. If they design according to the current criteria, I believe personally that the results will be significantly better than the EST trial.

Q90 Dan Byles: Have there been any trials subsequently?

Donald Daw: Sorry, just let me finish. I can evidence myself from my own trial that, as I say, has been audited by EST, where our average seasonal performance was 3.04, so above the target of 3, and the highest site we had was 3.45. These are all for air source heat pumps. In the research we have done, we have been running an air source, a ground source slinky and a ground source borehole all in parallel on the same heat emitter system in the same property doing different parts of the building and found the ground source with the slinky around 5% better than the air source and the borehole around 10% better, assuming equal technology. I think achieving above 3 is very realistic. You are absolutely right to point out that the design of the installation is the crucial element, but I believe MCS regulations now make the necessary design criteria available to all installers.

Q91 Dan Byles: Mr Butler, do you want to come in?

Kelly Butler: Not especially. The trial did continue, as you may be aware, and there was some very good news in the second part of the trial. For those who do not know, EST went back and did some remedial work on a number of the systems and the good news is that an 80% user satisfaction rating came out of that, so that is good, and the performances went in the right direction as well. The average performance increased as well. As a trial and as a learning activity it was very good, but I think Donald is right. A lot of these were pre-MCS systems. I think they very much helped us to define exactly what needed to be done, industry stepped up to the plate and, in fact, we see MCS as a progressive scheme. We are ramping it up all the time. We have just consulted on improvements to the design and installation standards ready for the RHI—that has all gone through—and we have increased the minimum performance of heat pumps to get certified on to MCS as well for air source and ground source. As an industry, I think we are going in the right direction, because everybody knows that if you want to build a sustainable market you can't have bad news. You have to be practical and realistic.

Q92 Dan Byles: I take it you would disagree with Calor Gas who in their evidence to us said, “Many heat pumps, when installed, do not do what they say on the tin, and no amount of taxpayers subsidy can draw a veil over that. Air source heat pumps emerge from independent testing as a bust technology undeserving of taxpayer support.”

Kelly Butler: “Many” is not a number.

Donald Daw: Yes, there are certainly heat pumps installed that are not performing as they ought to. That is without doubt, and I think that is a failing of the early days of the industry to put in the necessary checks and balances. I don’t believe that to be the case any more and I think, if we consider where we are in the cycle of the industry, we are right at the beginning. The technology will improve within the heat pumps and performance will get better, as will knowledge among installers on how to utilise a heat pump. Used properly, I think there is no better technology with running cost savings against all fuels, including gas and obviously very big off-gas grid and lower carbon. So a busted technology I think is unfair and unfounded.

Dan Byles: I thought that might be the case.

Chris Davidson: Two points, one serious and one flippant, the serious point being that DECC’s data in the installed systems is extremely encouraging now and we get regular updates from DECC on fuel monitoring. Secondly, Calor would say that, wouldn’t they?

Q93 Dan Byles: Is there a role for Government, though, in trying to legislate for a minimum COP? Is it possible? Is there a mechanism, do you think, by which a Government could try to legislate minimum COP?

Chris Davidson: As part of the RHI regulations already there are minimum COP requirements, which is very welcome.

Q94 Dan Byles: My concern is the difference between the design and the installation. It is easy to design a minimum requirement with the design of the system, but you can’t control the guy installing it. You have partially answered that, but do you think the Government could be doing more than it is currently doing to try to ensure that we have robust standards in design and installation, or do you think the current system is enough?

Chris Davidson: We can control the installer because the MCS regulations control both the product and the installation. The difficult one to control, of course, is the end user. The customer is very difficult to manage. We were installing—

Q95 Chair: Isn’t it meant to be the other way round? Isn’t the supplier meant to meet the customer’s needs, not the customer—

Chris Davidson: Point very well made, Chairman. I will just illustrate the customer. We were installing for 50 properties in a housing association in Leamington Spa and Mrs Smith was a real character. She was always out at the door, smoking a cigarette and talking to our drill rig operators, and the drillers thought talking to Mrs Smith was great fun. As a designer, I am very concerned about her door being opened 20 times a day for three minutes. That kind of behaviour is very difficult to manage and legislate for, more importantly.

Q96 Dan Byles: We have also heard some concerns that of course COP will fall when the outside temperature is colder, which is at a time when you need it most, and that it falls when you are trying to heat water to 60°C as required for washing, showering and so on. What are your thoughts on that? Do you see technology improving over time to help address those concerns?

Donald Daw: Of course technology will improve over time, but you are right that the fundamental challenge of a heat pump is the greater the difference between the required delivery temperature and the heat source the lower the COP. What I can say is that in the trials we have done the average winter COP for both sanitary water and space heating is around 2.98, not very different from the seasonal COP. We would recommend with heat pumps—and I think that is standard practice—that people do not store their sanitary water at 60°C but heat it periodically for any legionella risk aversion.

People generally, in my experience, are storing their heated water at between 52°C and 55°C, and at those temperatures, it is totally usable beyond the temperature you need for washing dishes or showering, also very low risk of legionella, and heating to those temperatures gives a seasonal water heating COP of between 2.5 and 2.7, even with an air source heat pump and a fraction higher with a ground source.

Q97 Dan Byles: It comes back to how it is used. The technology can be made to work, provided it is used in the right way.

Donald Daw: Yes. If I may add to that, the heat pumps that have been installed in the past five years are far less sophisticated from a control perspective than the current heat pumps. A heat pump that you could buy now would be much more intelligent and would modify its performance characteristics to optimise itself for the property, thus keeping the flow temperature as low as possible all the time to deliver the target space temperature, with the same theory applying for the sanitary hot water target.

Q98 Dan Byles: What is the typical installation cost for a three-bedroom semi, and how long would you expect the system to last before it needed to be replaced?

Kelly Butler: We did some analysis for RHI. It is very much dependent on what you are doing to the dwelling, obviously. The performance of a heat pump system is driven by something called the heat emitter guide in the MCS sense. As you go through the star ratings the cost of the installation increases because you are doing more to the distribution to get the temperatures to an optimal level. For an air source heat pump—and Donald may know better than me—we look at around £900 per KW of installed load. For a 10 KW heat pump you would be looking at £9,000.

Q99 Dan Byles: Life expectancy?

Kelly Butler: 15 to 20 years, normally.

Chris Davidson: The ground source should outlast the property. There is a ground loop in New York state that is on its second building. They knocked down a 1980s building and are on a second use of that ground loop. The ground source element is internal and there are no external components, so the lifespan should be 20 to 25 years for the heat pump.

I would say, just back to your earliest point, Mr Byles, that we can control ground source in a different way to air source. We do not have to provide heat, necessarily, when the air is so cold because we are hiding away in the ground. We can provide heat at any time at a similar COP. So there is a theoretical advantage to ground source, and that brings me on to a very important point about ground source. We can use it to manage demand on the grid far more effectively than air source technology.

Marcus Stewart: Can I come back on air source performance and the impact on the grid, because it is a very important point? Performance does drop as the temperature goes down at the point when the system is most stressed. What we see and what we put in our long-term projections is, as more and more heat moves on to the electricity system, you will have to build more infrastructure, particularly generation, for a short period of time to meet that energy demand. One of the solutions to that is having hybrid or bivalent devices in the home—that is using gas for a period of time, the very cold parts of winter and possibly hot water, and the performance of the heat pump at warmer temperatures where it is providing a more base-load heat—and when you look at that across the whole energy system, it is quite a cost-effective way of doing it, compared to just building electric heat pumps and having no winter—effectively, a peak shaving type approach.

Q100 Dan Byles: Does that require properties to have both systems?

Marcus Stewart: It would do, yes.

Q101 Dan Byles: There is quite a large capital cost there. You would need a gas boiler and you would need a heat pump.

Marcus Stewart: You would, but you would need a smaller heat pump than you would ordinarily have. There is a trade-off there. The heat pump manufacturers can talk more about this, but a lot of the heat pumps are designed to work in tandem with a boiler and certainly some of the newer boilers are designed to work in tandem with heat pumps as well. The two technologies are able to come together and that would also enable you to offer, in the longer term, balancing-type services to the wider network because you have that ability to move your energy from one system to another. Heat is potentially the largest energy that is going into a property unless, of course, you have an electric vehicle, longer as well. Those are the two main technologies that would be able to offer services into the system in the longer term. It is not necessary in the short term, but we see that as an interesting potential that allows the UK to move to its heat decarbonisation targets in a more affordable way than the full electrification of heat, for example.

Q102 Graham Stringer: Mr Stewart, you were talking before about the success of condensing boilers. Do you think there could be a change in the legislation to give greater incentives to people to install condensing boilers?

Marcus Stewart: With the legislation at the moment, it is very difficult not to install a condensing boiler. I am not an expert on boilers themselves, but what—

Graham Stringer: No, I mean to incentivise people to put them in before the old one wears out.

Marcus Stewart: There are 1.5 million boilers being replaced each year, as I said. You have quite a churn. There are potentially other opportunities—intervention points—where it might be sensible to look to upgrade a heating system, particularly if people are having building work done on a property. I know there have been attempts in the past to look at insulation and things when people have had building work done, but there are opportunities there and then to look at the heating systems and encourage condensing boilers.

We would support condensing boilers being fitted and also technologies that worked with heat pumps. There is gas heat pump technology out there as well that gives you better performance than a condensing boiler longer term. It is not quite as good as an electric heat pump, but you avoid any of the upstream issues in terms of having to build new power stations or additional electrical infrastructure. Longer term I think legislation should support those types of technologies and RHI should support those types of technologies as well to get the market moving.

Q103 Graham Stringer: Mr Davidson, what is the maximum density of housing stock that can be supplied with ground source heat pumps?

Chris Davidson: Going back a couple of years, we looked at a study in Reading and a study in London. The study in Reading was with Reading University, which we sponsored with some information and so on. London was with Cambridge University. In practical terms, we can serve almost all densities with housing and, indeed, commercial building stock with the right infrastructure and district thinking as well. We found that there were no real barriers, density-wise, to installation.

Q104 Graham Stringer: There is no maximum density?

Chris Davidson: There are maximum densities, but our cities just do not get there. Certainly, in central London, we could serve almost all buildings with ground source. There are practicality issues there. We don't want to knock down St Paul's to put a well field underneath it, clearly, but you might be surprised to find that the new shopping centre across the road from St Paul's, One New Change, is entirely heated and cooled with ground source. We can do an incredible amount and perhaps a lot more than people realise.

Q105 Graham Stringer: That is very interesting. What is the cost of retrofitting ground source heat pumps using vertical pipes?

Chris Davidson: If it is practical, so if the building has a car park, for example—

Graham Stringer: I am talking about urban situations.

Chris Davidson: The big thing about ground source is that the economies of scale are hugely important to the economics. The cost per KW that Kelly referred to earlier on in regard to domestic can be as low £300 or £400 per KW and can go up to £1,800 per KW, depending on the size of the scheme. Our company concentrates on the larger end of the scheme, the big schemes. The biggest that we have installed is 5 MW of heating and cooling at Mansfield Hospital. One New Change, which I referred to earlier on, is 2 MW. Per KW that is less than half of the cost of a small individual domestic system. That is hugely important.

Q106 Graham Stringer: Can I just talk about thermal energy storage for a minute?

Chris Davidson: Yes.

Graham Stringer: Does it work?

Chris Davidson: It absolutely works, yes. I put my PI insurance on it every day. Yes, we have lots of buildings out there. One New Change is an example where we are recharging the ground in the summer. We are cooling the building in the summer. We are then storing that energy and we are putting it back into the shopping centre in winter. We are also now innovating in storing other sources of energy—for example, solar thermal. Putting in a ground source heat pump is an excellent way of capturing some free solar energy in the summer and then vastly increasing the efficiency, the COP, of heating in the winter. It does not work with all geologies. In some cases—for example, down in Kent—there is quite a lot of moving ground water that would just wash that energy away, but most of the geologies in the UK are perfectly suitable for energy storage in one way or another.

Q107 Graham Stringer: You are in the business, so I am not surprised at that. Have there been teething problems elsewhere?

Chris Davidson: There have been some issues with certain types of systems elsewhere. There have been some issues, I understand, with systems where they are trying to store energy in aquifers. If there is movement of the water in the aquifers, clearly that is going to wash that energy away. It is all about modelling and understanding the geology. We employ geologists and hydrogeologists in our company and in our industry to make sure that we understand that, and of course we have increasingly sophisticated modelling apparatus available to us now. Clearly, if you stick within clays, water does not move around in clay. It is an impenetrable substance and so we can store energy very effectively. Under our feet at the moment there is about 60 to 80 metres of clay that is there ready to store energy.

Graham Stringer: There is a big underground railway station immediately below us.

Chris Davidson: It is best to avoid those.

Q108 Christopher Pincher: Back to the National Grid, so Mr Stewart's further opportunity for glory. Can we talk about the gas distribution network and I am going to quote at you, if you don't mind, your evidence to the Committee. I appreciate what you said about hybrid systems earlier on, but you said in your evidence, "There is still a role for gas in heat in 2050, as it is more economic to provide base-load heat for buildings with electric heat pumps and use gas boilers as seasonal top-up than to remove gas altogether". Robert Sansom of Imperial College suggests that there may only be about 10 days each year that require that gas top-up. I just wonder whether it is appropriate to maintain the entire gas distribution network for maybe 10 days of required top-up.

Marcus Stewart: Not surprisingly, our views differ to Robert Sansom's. We see a longer period, and there are a number of elements to look at as well. There is a short period, a 20 to 30-day period, potentially feeding into building heat. We see base-load heat still feeding into industry and also the gas networks are required to feed into power generation, which is generating electricity, but also thermal heat that can feed into heat networks. When you look at it as a balanced system, it comes out as more economic than removing that gas network and relying on electricity on its own. We have modelled this. We have worked with the Department of Energy and Climate Change and they have agreed with our modelling, and that is included in the heat strategy that came out in March this year. Their analysis is very similar to ours in that respect in saying that there is that longer-term role.

Not only that, there is a large amount of uncertainty between now and 2050. We don't know what technology is going to exist. At the moment, 23 million homes are connected to the gas network. There is the logistical challenge of removing people from that and forcing people to move to potentially higher-cost systems when there are options that will allow them to remain on the gas network. We should be looking at this in that broader piece and trying to do that balance between affordability, sustainability and security, which I mentioned earlier.

Christopher Pincher: Maybe we should ask for Mr Sansom's model, so he can show us how he has come to his conclusions.

Donald Daw: May I add one quick comment? Clearly there is a journey for these hybrid heat pumps combining gas and air, but there are countries in Europe—Sweden, for example—where they have virtually no natural gas network and almost everybody heats their building, whether it be a home or a commercial building, with a heat pump already. Clearly, there is a way for the grid to operate. Sweden benefits from having a very clean grid, mostly via hydro, so heat pumps are the perfect solution, and they began their journey in the 1970s after the oil crisis. There is a journey to undergo, that is for sure. I am not an expert, but I would think practically in the future there is no challenge to having a fully electrified heating system.

Marcus Stewart: You can get there. You would need to build an additional 50 GW of generation to supply that heat, if you think our peak demand today is around 65 GW. It comes down to the affordability and the economics of whether that is the right thing to do when you have a secure long-life asset that can supply that heat and provide that balance.

Yes, you can get there. It becomes more expensive, and we are trying to look at sustainability and affordability.

Chris Davidson: I would like to make the point that that is largely dependent on the mix of ground and air source, because air source heat pumps, as we have already discussed, have that extra efficiency penalty just when you need it that ground source does not have. If we increase the ground source mix then we can mitigate at least some of that electricity generation capacity requirement.

Q109 Christopher Pincher: But in terms of gas distribution affordability, you own approximately half the distribution network. How much does it cost to maintain that network? Can you break it down on a per-mile or a per-kilometre basis?

Marcus Stewart: We have just gone through our eight-year price control for the gas distribution network. We are a regulated business and that has come under significant scrutiny from Ofgem and stakeholders. The total cost for operating the network—that is maintaining it, updating elements of it, maintaining emergency contact centres, engineers to come out and deal with gas escapes and the whole management—is £11.9 billion for the eight-year period.

Christopher Pincher: Billion?

Marcus Stewart: Yes. That is for National Grid's gas distribution network.

Q110 Christopher Pincher: What impact does the Ofgem decision to cap your spending on gas distribution networks at £6.9 billion have? As I understand it, Ofgem have decided to cap your spending at £6.9 billion.

Marcus Stewart: That is for the mains replacement programme. That is factored into those costs.

Q111 Christopher Pincher: The balance is all the other things you have to do?

Marcus Stewart: That is right, yes. We operate a 30-year mains replacement programme, which is a safety-driven programme to replace cast iron mains with plastic mains that will then last for 60 to 100 years and reduce leakage, methane leakage but also improve safety. Under the Rio negotiations, that was reviewed and capped.

Q112 Christopher Pincher: In terms of your other written evidence, you said, "Replacing the gas network with a community heat network has not made economic sense for most places in the UK", but UKERC says that heat networks are cost-efficient compared to heat pumps over the long term. There is another oral from Robert Sansom who suggests that a heat pump will cost something like £986 per household, whereas a heat network is £596 per household, and the total revised cost in both cases is something like £1,915 for heat pumps and associated technology and £1,124 for heat networks. Why do you think his figures differ?

Marcus Stewart: I can't comment exactly on his figures. All I can say is the evidence base that we used for our submission was partly from some work we did with Delta-ee, who surveyed all the different types of manufacturers of heat pumps and heat networks, looked at their costs and technologies and matched them to different property types and different property demands. That evidence suggests that heat pumps and heat networks both require ongoing Government interventions to encourage people to use those right out to 2050, compared to using a gas boiler. Even with increasing gas prices and even with a carbon price, there was still the requirement for some sort of intervention because of the costs of the new technologies.

In our future energy scenarios that we produce on an annual basis—there is a document here where we take the views across the industry, the electricity industry, the gas industry, consumer groups, technology providers—and with that analysis, we see roles for all types of technologies to get you to 2050, but it is a balance. Heat networks work well in commercial and some industrial situations. Heat pumps work well in some situations, particularly when you have a well insulated, low heat demand, and hybrids work better in other situations.

It is a balanced approach and that is what we are advocating, and it allows you then to move in a more cohesive way from where we are today to where we want to get to in 2050, rather than removing the gas network and building heat networks and effectively replacing an asset that is a long-life asset—by the time we get to 2050, it will be largely depreciated, so its running costs will be reduced—and rather than building a brand new asset.

Donald Daw: If I may add just one very small comment. It is not necessary to separate heat pumps and heat networks. A heat pump could provide the heat for a heat network. An example is a project we have just completed in Kingston upon Thames, a 2 MW project using a water source heat pump, taking heat from the Thames, distributing heat to 137 homes and 142 hotel bedrooms. Where the heat comes from and should you use a heat network are two separate questions, and the heat could come from any source.

Q113 Albert Owen: Taking on some of the issues that you have just responded to, Mr Stewart, with regard to electrification of the heating network in general, you mentioned some rather large figures that I did not catch with regard to if we went totally to electricity you would need to obviously create a bigger grid. What did you say you would need?

Marcus Stewart: I think it is in the order of 36 GW of additional generation, but I can confirm that in writing.

Q114 Albert Owen: Yes. If that kind of figure was needed, how much extra cost would that bring with it?

Marcus Stewart: I can't tell you off the top of my head.

Albert Owen: Yes, but it is considerable, isn't it?

Marcus Stewart: It is considerable. If you think of the investment that is required just to maintain the level of generation that we have today and replace the existing power

stations, if you were to increase that by a factor of 50% or 100% additional amount that is a significant amount of generation. If we don't go for a balance solution then you end up building generation to run for short periods of time and that becomes expensive in itself.

Q115 Albert Owen: Successive Governments have talked about the future as electrification of surface transport and heating, so we are going to need that kind of investment and the customer is going to have to pay for it at the end of the day. Is that, in your mind, a huge contribution to the rising bills?

Marcus Stewart: The existing investment or future investment?

Albert Owen: Investments for the future.

Marcus Stewart: It is difficult to say because one of the areas where you are going to see additional costs, potentially, is in the electricity distribution networks. They are in the process of going through their price control. I think in the next eight years we are not seeing a significant amount of increased costs in that area because the view is that we are not going to have the impact of large amounts of electricity demand in the next eight years. In fact, our projections have shown electricity demand is reducing in the short term, but when you move out to beyond 2020 to 2030 or 2035 that is when you start to see an increase, when you have more electric heat pumps and potentially more electrification of transport.

There is a timing issue to this as well. At the moment, we do not foresee a huge amount of investment in meeting demand. The investment that is driven around the electricity network from our perspective is connecting new sources of generation. That is what is largely driving our investment.

Chris Davidson: I would like to make the point that, within the timescales that Marcus is talking about there, improvements in control of the heat pumps, as we talked about earlier on, and more ground source rather than air source, as I have talked about earlier, mitigates a large amount of that extra generation capacity, certainly in my opinion and in our industry's opinion.

Donald Daw: May I make one simple, practical comment? An air source or ground source heat pump, because we are supporters and manufacturers of both, would have a peak demand in a typical home with moderately good insulation of somewhere between 3 KW and 4 KW, not dissimilar to turning your kettle on. While I can't comment on the mass infrastructure of the grid, if we allow people to boil their kettle when *Coronation Street* or the football match ends then things do not collapse in the short term. If we had more intelligent control of consumption in the home, it would be possible, when we do our cooking or we turn the kettle on, to turn the heat pump down to a lower level. In a reasonably well insulated house, you could turn your heating off for an hour and not even notice. I think demand site control in the home and on the grid will play an equally important role as investment in more generating infrastructure, but that is from a one-off, simple, individual home application.

Q116 Chair: Just on the back of that, are the smart meters an important part of delivering that?

Donald Daw: Smart meters are a key first step, and once we understand what the communication protocol is going to be around the grid then we, as manufacturers, can develop our systems so that they can operate to facilitate that. I think it is a key part of it, but we still need further clarity.

Kelly Butler: Can I make a point on the smart metering? We have talked about quite a lot of separate policies here that are all integrated, but there is no strategic method of bringing them together. In our submission to the inquiry we advocated the development of renewable heat zones and we put that forward for a reason, the reason being that we have a smart metering rollout that lends itself to the smart operation of heat pumps. The DNOs are just about to enter a new price control period in 2015 but not knowing where heat pumps are going to be, necessarily. It would help if they could identify clustering of heat pumps, so they could spend in their business plans exactly where the growth is coming.

We have antipathy in installer networks in the short term, “Should I get into renewable heat? I could put in an old boiler. I could put in a gas boiler,” and so on. There are quite a lot of different things that need to be brought together. Our view is that we need something a bit like we had for HECA Action back in the 1990s with the Home Energy Conservation Act where you have a local or a regional zone that has a three to five-year plan to say, “I’m going to have 50,000 heat pumps in this area,” for example.

If I know that is going to happen, as an installer I am interested in paying money for the training and the MCS to get involved in that. If I am a DNO, I know that I am going to have to spend money on upgrading the network and then we do not get bill shocks from customers where they find that they are being charged £11,000 to connect to a heat pump, which is a substantial amount of money. The DNO picks that up in the price period. Manufacturers and local authorities can target their marketing.

We see ECO and the RHI and the Green Deal being targeted into these areas and also it helps the energy supply where they may be able to target time-of-use tariffs and the smart metering rollout emphasis as well. We are quite big advocates of that clustering approach and we think that can be achieved without that much Government support. We think industry can probably put that together through an independent trust and we have been in discussions with DECC and with one or two major energy suppliers about how we might be able to create that.

Chair: Thank you very much for your evidence. It has been most helpful. There could well be stuff we want to follow up in writing, and, similarly, if there are any flashes of inspiration you think you did not manage to get across, if you could write to us we would be grateful. Thanks again for your contribution.

Examination of Witnesses

Witnesses: **Dr Richard Leese**, Director, Energy and Climate Change, Mineral Products Association, **Paul Blacklock**, Head of Corporate Affairs, Calor Gas Ltd, **Jim Lambeth**,

General Manager, Solid Fuel Association, and **Mike Mason**, DPhil Researcher, University of Oxford, gave evidence.

Q117 Chair: Thank you very much for agreeing to give evidence on this inquiry into heat, which is proving a fascinating topic. For the record, could you introduce yourselves with your name and organisation, starting on the left?

Paul Blacklock: Paul Blacklock from Calor Gas.

Jim Lambeth: Jim Lambeth, Solid Fuel Association.

Dr Leese: Richard Leese, Mineral Products Association.

Mike Mason: Mike Mason. Slightly complex—I am heading a research group at Oxford on some completely new renewable energy and I am a private developer of ultra-low carbon homes, but previously I was energy adviser to the president of the Maldives, where my task was to make it the first zero carbon country. Unfortunately, a coup intervened.

Chair: Hopefully, that does not follow you to this country.

Mike Mason: Thank you. I hope so, too.

Q118 Chair: I will start with the opening question. A lot of people have been saying that we need a whole systems approach and maybe you have your own views on how you see that whole systems approach.

Paul Blacklock: Yes. We had some issues with this right from the very start. The strategy seemed to be, and was, decarbonise electricity and then put everything on to electricity—that is heat, vehicles, the lot—and that carried with it a very big price tag. It did not at the time seem to take account of some of the issues that Marcus from National Grid was talking about, where you have a very concentrated amount of heat demand happening in a very short period of time: 20% of heat demand occurs in only 31 days of the year, and those 31 days of the year do not come neatly on 1 to 31 December. They all dot about and the thoughts of having sufficient electricity generation to meet that peak demand, particularly when you think back to December 2010—that was very cold and we saw our demand in our business leap by 50%.

That is 20% in a normal year. You go to a very bad winter, and as was being commented on earlier, it is only 11 days, but if that is 11 days or 20 days where your system does not work and you have no heating then there will be a big reaction. We have always argued that there needed to be a portfolio approach, and we are pleased to see that is what DECC have now started to talk about in their latest iteration of, the heat strategy. They have gone away from pure electric play to one where you have scenarios where, even by 2050, and keeping within the carbon budgets, gas absorption heat pumps, for example, are the main technology, along with the hybrids and the heat pumps—a whole raft of stuff.

Q119 Chair: Are there any other views?

Jim Lambeth: Yes, I would totally agree. I think it would be foolish to have all your eggs in one basket, as the old saying goes. You have to have a spread of different energy

sources because we have all seen the occasions when we have shortages in one direction or another. Perhaps we will come on to this later, but there is no question that many members of the public are concerned about the long-term strategies, about the security of supply, and certainly from our point of view—though I imagine my colleague to my right here would agree—people are demanding some sort of security whereby there has been a massive increase in demand for standalone space heating appliances in domestic residences because they are concerned on two counts, cost of fuel, thinking of gas and electricity, and security of supply.

Dr Leese: I think a system approach probably means different things to different people. I am from the manufacturing sector whereby we extract minerals, we manufacture mineral products and then we provide building solutions whereby the benefits of concretes and thermal mass properties can be used in fantastic buildings like this. The manufacturing sector already looks at a systems approach. Each manufacturing process is an internal system, and we recover and use a lot of waste heat from the process. We need to design buildings for long life.

We need to take a long-term view and a whole-life approach to buildings, but what we see is a regulatory and incentive system that is targeted towards the domestic sector and somewhat leaves the industrial sector behind. What I would like to see, in terms of a systems approach, is equivalent support. We see the RHI targeting technologies and activities that my sector does not have access to and perhaps I could expand on that further later.

Mike Mason: I think if we are going to look at a system approach, there are three big legs on this stool. The first is politics and we have the Climate Change Act that mandates an 80% cut by 2050. In that context, the Climate Change Committee say, “Well, because there are unavoidable emissions that we can’t reduce—old coal mines and the like and some in agriculture—we are going to have to make 90% among the things we can do.” Then if you follow the Climate Change Committee’s recommendations on aviation and the Government’s policy of 2050 emissions the same as they were in 2005, what you have left for the domestic sector is 5% of what it currently is. That is the politics.

Let us look at the grid. In 2010, we consumed 440,000 GW—that is 440 TWh—of heat. If you divide that by let us call it 2,000 hours a year, a quarter of the year heating—that is 12 hours a day six months of the year, in reality it is less—that is still, wait for it, 200 GW. The current generating capacity in the UK, with everything going full blast, is only 90.

Then you have to look at the house. Within the house what we have is an Anglo-Saxon hut with attitude. It has mud walls; it has sticks on the roof; and it was designed, by and large, to ventilate. The roof of a house is designed like an aerofoil. What we know, and what I know from personal experience of doing houses, is that houses suck air out. If you were to look at the correlation between wind speed and heat demand, I think you would find—and I have never been able to find the data—that it is huge. The great resource we have in this country is correlated with our greatest demand. It is heat.

The systems approach has to look at these three things. We are not talking about fiddling with a little bit here and a little bit there. We do not have the solution to the conundrum posed by the Climate Change Act. That is not to say we could not have the solution but, frankly, gentlemen, we do not have that solution at the moment and we have to stand back

and say, “What do we want to achieve? What resources do we have? How do we integrate supply, demand and politics and take the holistic view?” Unfortunately, we do not do that very well.

Q120 Chair: That is a good challenge to the inquiry. I wondered if you had any thoughts on the costs of different approaches to systems.

Mike Mason: I have. None of these are my own costs. These are all derived from quangos or Government. The Energy Savings Trust reckon that to insulate a house properly to 2010-2020 standards, not to 2050 standards, costs between, at the low end, £9,000 and, at the high end, £20,000 per home. We have heard from the gentleman who is now behind about the cost of heat pumps, but let us set the cost of heat pumps aside. Heat pumps are going to be crucial in this story. By 2050, we will have about 33 million households. Let us not forget population growth, so 33 million households. We have 400 months. We have to do 30,000-odd homes a month. We will spend 1% of GDP insulating our homes, using the EST’s numbers, not mine. I think they are light, but that is a measure of the scale of money. The detailed numbers are in the evidence that I have submitted.

Q121 Albert Owen: Most of what we have been discussing in this inquiry and with previous witnesses has been about the grid and the challenges for those that are on the grid, but even bigger challenges for those that are off-grid and in rural areas of the country. They are often paying more and they are often using more polluting fuels, so there is a great challenge there. What relative advantages of different heating solutions are there for the off-grid in terms of reducing carbon and economic costs?

Jim Lambeth: I think if you approached the last part of that question about reducing carbon, undoubtedly the most useful methodology currently is burning wood—logs and the like. There is modern technology using wood pellets, for example, but the fuel itself is quite expensive and the appliances are very expensive. So the cost savings are minimal in the short term. Although this technology is out there in the marketplace and is all terribly attractive, in reality what most people do is resort to the good old-fashioned way of having a fire, whether it be an open fire or, more popular these days, a closed appliance—a stove with glass doors on the front—burning logs.

This is a strange phenomenon, which most people can’t seem to get their heads around. We have been hearing so much about technology moving forward and ground source and air source and high efficiency condensing boilers, but the fact remains that the most popular appliance currently in our sphere is the wood-burning appliance. There is extraordinary demand from the public, and this flies in the face of all Government thinking about climate change and everything else. The fact is that Mr and Mrs Joe Public want, as I said earlier, security of supply.

It is a fact that during all the period of the economic crisis we have been going through—companies going to the wall and people suffering left, right and centre—there has been a boom in the sale and installation of these very appliances to the tune of, it is estimated, between 175,000 and 200,000 appliances a year. Pretty small beer compared to the size of the gas market but, nevertheless, a significant market and this has been growing year on

year and it does not seem to be slowing down. We believe that the reason for this is one of cost. People perceive that it is—

Albert Owen: Sorry, Mr Lambeth. They are moving from what fuel to—

Jim Lambeth: Not moving from; they are adding to. They have a house that is already centrally heated. The majority of houses in the UK have central heating of some sort, with a few exceptions. They have central heating, whether it be gas, LPG or oil, in rural areas we are talking about now. Obviously, a number of those people, thankfully, use solid fuel—that is why I am here—but it is a fact that people are liking the notion of having a freestanding appliance in the sitting room that allows them to reduce their normal heating running costs, because if you light a fire in your living room the central heating—I will not say it shuts down, but it reduces the demand for heating in the property and invariably the running costs are considerably less.

Many of these modern appliances are now touching 80% or more efficiency, so they are pretty good by comparison. There are running costs. If you have access to cheap wood, so much the better. That reduces your costs still further. Overriding this, what I sense is that people are running scared of rising bills and concerns about security. We hear a lot of concerns about potential power cuts and so forth that may happen because the coal-fired power station is shutting in a couple of years' time, and where the hell are they going to get to their electricity from? These are planned closures for which there is no solution. What is happening is that people are buying these appliances as a form of security, and they like them as well. It is a very attractive appliance that is nice to have in the house.

What seems to have happened is that people are having these to supplement what they already have for both causes, that is for security and to reduce their running costs. It is working. People are buying these things like there is no tomorrow. The UK market has opened up to manufacturers from all over Europe and installers and dealers are cropping up in every high street. The proof is in the pudding here. This is not speculation. This is physically happening.

Q122 Albert Owen: I would put it to you that in my area many people are having additional appliances, like you say, but their first choice would be connection to the mains grid, so that they could have gas cheaper and benefit from dual fuel prices that are reducing.

Jim Lambeth: Of course. If they have access to the grid then all well and good, they can have a high-efficiency gas condensing boiler, but they obviously still like the additional. Of course, in rural areas they do not have that luxury, necessarily. They are reliant upon other fuels, which are inevitably—

Albert Owen: But it is not their first choice then, is it? That is what I am trying to say.

Jim Lambeth: It may be their first choice.

Albert Owen: Again, with respect, I do speak with them quite regularly and many people who do have the option of going on a mains grid would go on the mains grid before they buy another appliance.

Jim Lambeth: I would not disagree with that, but if you are talking about people living in rural Derbyshire where I live, they do not have choice. There is no gas there.

Albert Owen: What I am saying is, do you think they should have the choice? I know, as a commercial entity, it would not be in your interests.

Jim Lambeth: It would not be in my interests because I am looking at the wider picture in relation to the population. Yes, of course it would be advantageous, but practically speaking it is never going to happen because—

Q123 Albert Owen: My question to everyone on that—and I realise where you are coming from—is should the Government do more to allow gas distribution networks to grow then?

Jim Lambeth: I would have no objection to that.

Mike Mason: No is the answer and there is a very clear reason why. Let us just deal with wood, first of all. The UK's total wood harvest in 2011 was 10 million green tonnes, 25 TWh, 5% of our heat load, even if we took it all out of the uses it is currently put to to put into houses. It is pretty. It is nice. I have them in my house, but it is not going to do anything to the nation's heat problem. What you do not have in the rural areas is population density and so the cost of a gas grid per house is generally higher.

We know that we have to decarbonise heating, so it does not make sense to me to be investing massively in a more than averagely expensive distribution system for a heating system we know we are going to phase out. On the other hand, in the rural areas you do have a couple of things going for you. There is certainly some amount of wood. You have space. While ground source heat pumps are space consuming if you go for the slinky type thing—they are much less space consuming, clearly, if you go for vertical boreholes—you have space. You have options available.

All of these people are on the grid. They face the greatest cost of heating at the moment and they are the place where we could do that most important thing in our heat planning, which is develop a market. I have built a few houses at near zero cover. I promise you that the architects do not know what they are doing, the M&E people do not know what they are doing and the builders do not know what they are doing. I pity the poor chaps who are trying to sell this stuff because, as we heard earlier, there are massive amounts of mis-installation and misinformation. They do work well when you get them right.

What we could do is use the rural areas, where there is the highest marginal cost of heating, as pioneers for developing the market that is going to satisfy 33 million homes by 2050. I think there is a real opportunity here and it is not with gas.

Q124 Albert Owen: I hear what you say but, again, we have to deal with the rural fuel poor as well and not just in a pioneering—

Mike Mason: I am not arguing the politics. I am simply saying that is—

Albert Owen: That is not politics. That is the reality of heating.

Dr Leese: If I take your example from a policy perspective, while recognising that your constituents might look at it from a different perspective, the policy suggests that installing a biomass boiler might be one of the solutions. If we had a tonne of biomass here, it is incentivised via the Renewable Heat Incentive to put in a biomass boiler, whether that be a commercial boiler, an industrial boiler or a domestic boiler. The same tonne of biomass is incentivised to using power generation through renewable obligation certificates. The same tonne of biomass is not incentivised at all to be used in something like cement manufacture or lime manufacture or manufacturing industries that use direct heat. We have a disconnect in the policy system that is incentivising less efficient, potentially, uses of what is a scarce biomass resource. I think you are right to point out the difficulties of the off-grid sector, but at the moment we have a policy landscape that is incentivising the direction in the wrong way—

Q125 Albert Owen: I will come to Mr Blacklock in a second, but the response from the three of you does mean in practice bigger upfront costs to these people to change. They are already paying more for their fuel in the upfront costs. There is a problem there. That is why I suggest that Government should maybe be doing more, whether it is gas mains or whatever, in the interim, so they can move towards that as a transitional thing. I know it would not be a way we could do something with the grid afterwards, but those upfront costs are the reality that inhibits people. They are already on tight budgets. They are already paying more, and you are saying they should pay these additional costs. It is not a very attractive proposition.

Jim Lambeth: I think it has to be recognised that there is a massive difference between people living in London or any other urban district and those people, as you say, living on very tight incomes.

Q126 Albert Owen: I am not talking about very rural places or isolated properties.

Jim Lambeth: Yes, certainly.

Albert Owen: I am talking about large hamlets and small villages that are very close to gas mains. There is not much joined-up thinking there. Mr Blacklock, in your evidence you submitted to us a very interesting potential of rural biomethane in the United Kingdom and possibly the grid. Could you expand on that and how that would benefit those not on the heating system?

Paul Blacklock: I will start at the beginning, which is in terms of grid expansion. You asked should the grid be expanded.

Albert Owen: Yes, sure.

Paul Blacklock: The decision on that is an economic decision because the grid was established by British Gas when it was a nationalised company and it was vertically integrated. I can remember somebody telling me at the time that its investment strategy was that they were investing for their grandchildren. There was no economic analysis. It was a social expansion of the grid. Of course, as soon as you separated those two out, you had a situation where you disconnected that ongoing revenue stream in terms of selling

energy from establishing the grid in the first place. That is the first hurdle you would have to overcome, but that is an economic decision.

You asked what the best thing is in terms of improving energy efficiency in off-grid Britain now and, given that the vast majority of people use a boiler central heating system with radiators, you have to look at boiler replacement. Still 60% to 70% of boilers out there are F and G rated and probably the most successful carbon reduction and bill reduction programme in the past five years was the boiler scrappage scheme because that took 125,000 boilers out of the market early in the space of about three or four months. Of course, the big advantage it had from an industrial point of view is we are the largest gas boiler market in Europe and at least two-thirds of those boilers are made here. There is a knock-on to the manufacturers. There is a knock-on to the installers who suddenly had full order books, and you ended up with consumers who were happier because, for the smallest amount of capital investment, they were able to reduce their bills.

In terms of biomethane, and in our case biopropane, that is more about decarbonising the grid you have as opposed to expanding the grid. Early doors, some people were talking to us about, "If we were making biomethane on a farm, you could pick it up and then go and deliver it round to customers." With CNG that is not feasible, and you have to then look at establishing the gas networks against a reality that everyone is sat in their house with a boiler that might only be three years old and an oil tank that is only two years old. You are not going to get this mass conversion and, of course, there is the unknown in terms of cost.

Q127 Dr Whitehead: Can we talk about the policies and incentives to reduce the environmental and economic impacts of domestic heating, which we have already mentioned to some extent: ECO, RHI and the Green Deal. What effect do you see these having in meeting the challenge of heating, both from the costs and emissions perspective? How effective do you think they are like to be?

Paul Blacklock: From our point of view, we think the problem has been that you have been setting the bar too high for consumers. The default position has been, "You need a renewable system, whether that is biomass or heat pumps," and that inevitably carries with it a large capital cost. While I have been in the industry for almost 30 years, I have to acknowledge that heating is one of the most boring things on the planet and the general public do not think about heating every waking moment of their life. You only change a heating system either when it is costing you too much or usually when it is broken: 80% to 85% of heating system are distress purchases.

In terms of deploying newer technologies, you need to try to work much more in that model where they do not break down in the middle of June on a sunny day. It is in November and it is minus 5°C and granny has come at the weekend or whatever. You need a quick solution. The problem where you set consumers this high bar is that then necessitates a whole raft of incentives that have to come behind it to try to support and make it economically viable, but you still can't escape the fact that the sort of people that Mr Owen and all the members of the Committee are concerned about—people in fuel poverty—are not the people sat there with capital. These solutions are not available to them, and you can see that with the rollout of solar PV and the type of houses of the people that installed those.

Jim Lambeth: I would concur. The technology is there. Whether it be a pellet boiler, match-fired, wood-fired, whatever it is, they are very expensive pieces of kit and you rightly say, if you are talking about people in fuel poverty in rural areas, sorry, it is just beyond their reach. Despite the fact that this technology was heralded several years ago, the actual take-up of the biomass boilers, for example, has been extraordinarily low. I remember on occasions people quoting figures to me that were just pie in the sky and the reality is that they have not sold as many units as they would have liked to have done.

The factories are jolly expensive, plus you have to have a great deal of infrastructure in the house to be able to install these things. They are pretty big boilers in the main. They are fine for nursing homes and hotels, but in an average three-bedroom semi, I am sorry, it is not a feasible proposition. Yes, the technology is there, but it is almost too sophisticated and very expensive. It is an answer to the maiden's prayer, but it is not achievable, as my colleague here says.

Dr Leese: I have mentioned why I think RHI is missing an opportunity in industry. There is considerable opportunity there to switch to biomass fuels. The Green Deal is focusing on energy efficient products and it fails to benefit systems that are for both a structural and thermal benefit. If we look at Green Deal specifically, extending that, if somebody is undertaking some structural work on a property, incentivising them to include some external insulation or introducing the benefits of thermal mass into the property while they are undertaking that structural work. Green Deal misses that opportunity because it is narrowly focused.

Dr Whitehead: Like the consequential improvements regulations, which appear to have died a death.

Mike Mason: Taking the three things in turn, ECO, fine. It is about electricity. These are relatively short-life appliances, you can switch them and you can switch them as generations change, I do not have a problem with that. The RHI is kind of there, but it is not because, going back to your opening question about systems, it encourages you, in some respects, to have an inefficient house for which you are paid quite a lot of money. We have a house in the country, I hasten to add, and we get paid quite a lot of money for burning things inefficiently. I do not think it is pitched right, and it does not recognise the value of efficiency.

The Green Deal purports to do that, but it has two fundamental problems, in my book. The first is that everything you do under the Green Deal will be inadequate to meet the 2050 world that we have to be aiming at. That is born of practical experience, trying to do this in homes. Therefore, it is likely that everything you do will have to be—with the exception of cavity wall insulation—taken out and done again. This seems to me, were it to be successful, which fortunately it is not, a great misallocation of public resources. The second thing about the Green Deal is that I do not think it will work because it imposes liabilities instead of giving people assets. If I take on a house with the Green Deal attached, I do not know that it does not have the problems that a building I was recently involved with had, which is when I went into the loft I found the insulation was there, it was all beautifully rolled up and had not been unrolled even.

There is nothing about the Green Deal that says the performance potential is being achieved. It is your point earlier about heat pumps. The missed opportunity here is around

something which says, “Let’s create an asset,” and I will take for example mortgage interest relief for houses that achieve an objective standard of energy consumption. I do not mind carbon; I do not know how you balance that between electricity and efficiency. There are all sorts of things, subtleties you can do there. But then you create a house that is worth more, whereas if you sell a house today with a Green Deal loan attached to it you have created in the buyer’s mind the suspicion, the danger, the risk of this liability unattached to a benefit. Personally, I do not think the Green Deal will work. Fortunately, I do not think the Green Deal will work, and it is a huge missed opportunity to do something really interesting.

Q128 Dr Whitehead: But doesn’t ECO start down the road of, particularly in terms of retrofitting hard-to-treat homes, creating exactly the sort of asset you are describing in a way that does not necessarily require what I take to be part of the critique of a number of these systems? It requires a rather detached, rational calculator to deal effectively with the challenges that are put in front of the person, when they are not like that in real life, whereas ECO maybe deals rather differently in that sort of process.

Mike Mason: What would make all of these things more coherent is a very clear statement of what a house needs to look like to achieve the policy targets we want, and then all of the different pieces can be aligned with that clear vision. What I do not see at the moment is a clear vision of what that house looks like. You might have a variety of different categories, but there is no common vision of how the policy that the nation has—and it was a very popular policy, by and large—around the Climate Change Act is going to be delivered. Until you have that, everything is a stuttering, slightly misaligned step, and that is what worries me here. It is not that these are not well-intentioned, often doing good things, and Green Deal would reduce bills were it to be applied properly in the short term. Should we be doing things that we are going to have to undo? That is a political and economic decision, but it is not one that I think has been made.

Paul Blacklock: Part of the problem for off-gas grid is the access to these schemes is limited or non-existent. If we take the affordable warmth element of ECO, we have a situation at the moment where none of the Big Six offer LPG or heating oil boilers, either repair or replacement, because they are obviously under the cosh to deliver ECO for as small amount of money as possible, and they say that putting in LPG or heating oil boilers travelling into the countryside costs them too much money. We have had customers who are eligible—they meet the criteria for affordable warmth—but they are not able to access these schemes because even though they are paying for them through their electricity bill, although Ofgem say it qualifies and DECC say they qualify, the Big Six obviously do not have it on their list of what they deem affordable measures. But even if you extend it to the Green Deal, we had one of Mr Byle’s colleagues only last week complain because she had a constituent that could not get a Green Deal assessment because she was in an off-gas grid area. We are not talking about somewhere where Mr Owen lives. We are talking about the Midlands. You do not have to go miles to get to the fields there.

With access to these schemes—and it comes down to the design of the scheme—you have the Community Savings Carbon Obligation that has a threshold of 10,000 people. That is an off-gas grid. That is suburban. It might be a rural market town, but it is not a village. So you have to look at the design and access to these schemes as well, to give them half a chance of working. The reality in the countryside is every house is different.

Q129 Dr Whitehead: Do we go down the building regulations route, where you put a regulation in and no one notices, and apparently things then change as if by magic?

Paul Blacklock: It depends on the rate of how much you want to accelerate that. Part of the problem with the rate of improvement that was seen in terms of delivering zero carbon homes by 2016 was putting such a cost on to new homes, particularly at the moment when the housing market was struggling. As soon as you go to off-gas grid areas, the cost of building houses can be increased by more than 70% because you are talking about small builders, and they are not building big 200, 500 Barratt Homes developments. You have to balance the two in terms of the cost—what was the cost of the end product?—but I always think you have to do these in steps, and trying to do it all in one go will usually defeat it.

Q130 Dr Whitehead: We have already heard about mandating condensing boilers through building regulations, effectively.

Paul Blacklock: That was 2006 and over the past 10 years we have seen our gas demand per customer that we serve decline by 20%. That is coming through from more efficient equipment, more insulation, the energy is more expensive, and they are putting in wood burners, and the ONS statistics that came out only six or eight weeks ago confirmed exactly the same was happening in urban areas. You do have heat decarbonising, for want of a better phrase, across the country, and because we saw the real acceleration happen from 2006 and my job is involved with the company strategy and what our business is going to look like, we are forecasting that that decline is going to continue.

As you are seeing, new technology is coming through. Whether it is hybrids, gas absorption heat pumps or micro-combined heat and power, that curve or line is going to continue to go—

Q131 Dr Whitehead: Why not institute some of those developments into building regulations in the same way that condensing boilers were? Are there other winnable areas that might be sufficiently incorporated into building regulations or similar in order to make those differences?

Paul Blacklock: You have to be careful that you know that it is going to work before you do that because if, for example, you mandated heat pumps in all new houses from day one as of now, there would be concerns in terms of whether they were going to deliver the performance they were promised. You want to be sure, whatever the technology is, that it is going to deliver what it says on the tin.

Q132 Dr Whitehead: Thermal mass apparently works, for example.

Dr Leese: It will, and building regulations has a role to play. For a heavyweight building, you pay a bit of a penalty of 4% embodied CO₂ footprint, but that is paid back in just 11 years and that is in a residential property. The payback period is probably a year in something as sophisticated as this building. Building regulations have a role to play. SAP at the moment is a little bit crude, not so sophisticated, particularly the overheating check in SAP. With a review of building regulations, a more long-term focus on the built environment, we stand a chance.

Jim Lambeth: You have to be careful with building regulations. They are specifically written for new properties in the main. Obviously, we know a lot can be done to improve the carbon footprint to a new house. You have to recognise that the vast majority of properties are existing, and the only way you can get building regulations to influence that is to put some requirement on controls, minimal efficiencies, and so on. Then to some extent you are regulated by the technologies that are available to you.

The vast majority of houses in the UK are existing and that is a much more difficult nut to crack. I live in a somewhat typical Victorian semi, albeit in a rural area, with solid brick walls and single glazed windows. Without spending an absolute fortune, there is not a lot I can do. I do not have a loft to insulate. I do not have cavities to insulate. All I can do is put some double glazing in.

Q133 Dr Whitehead: But the mandatory boiler replacement regulation dealt mainly with retrospection, did it not, as indeed the attempted consequential improvement arrangement also dealt with it?

Jim Lambeth: Yes, it did.

Q134 Dr Whitehead: I take the point that by 2050 most of the houses that are already there will still be standing of course, but what I am seeking is whether, bearing that in mind, there are elements of building regulations that could, in the context of low carbon heating, start to replicate the successes—

Jim Lambeth: Without wishing to burst your balloon, or everybody's balloon for that matter, I think you also have to recognise that every man in the street is not terribly excited by all of this. He just wants to heat his home in the cheapest possible way, and when you start talking about carbon emissions and climate change, he just twitters off. Sorry, perhaps it is not comfortable to hear this in these haloed surroundings, but the man in the street is bored with it and he is not interested. When you start going on about high efficiencies and all the rest of it, no, sorry, they are more concerned about putting food on the table.

Dr Whitehead: Presumably, that saves cost in the longer term. There may be a bit more—

Jim Lambeth: If you can show those are tangible. But then that is in the Green Deal. You are harnessing people with enormous burdens. I think they are a disgrace to follow.

Can I interject one other thing? Something cropped up earlier—I am going back a step now—but there was a golden opportunity missed when they were discussing the introduction of the Renewable Heat Incentive, which I think is partly judged as one Green Deal, when there was a proposal made from the stove manufacturers that there should be some recognition that some assistance should be given to people who wish to install a high-efficiency wood-burning stove, and they were turned down because the only appliances that were recognised were these modern automated boilers, pellet boilers, wood chip boilers and the like, which are way beyond, as I already said, most people's scope. The simple appliances were not recognised as being worthy, and that was a missed opportunity because that would have encouraged more people to burn wood, but it is water under the bridge.

Q135 Dan Byles: I would like to explore a little more about industrial heat—you touched on it earlier briefly—and reducing demand for industrial heat. Jim Ratcliffe, the chief executive of Ineos, stated earlier this month, “It is fine being very green but not if you are interested in manufacturing. The UK is already disadvantaged on the wholesale cost of energy and then it puts taxes on it. Anybody who is an energy user is just going to disappear.” Do you think there is a risk that Government environmental targets could drive industry abroad, or do policies such as the energy intensive industries compensation package successfully mitigate this risk? I suppose that is to Dr Leese initially.

Dr Leese: On the package specifically, it is tangled up within state aid and certainly the cement and lime sector have not seen anything out of that. I know the steel sector are getting some payments because they qualified on a list created by the European Commission.

In terms of carbon leakage, it is definitely a risk. We, as manufacturers, recognise our environmental responsibility, and the cement industry is the first national cement industry to create a 2050 greenhouse gas strategy in which we say we can achieve a minus 81% reduction in greenhouse gases but only with a certain amount of support. Within that we have said that the biomass use in the cement industry would need to be 40%. We need to be replacing 40% of the thermal input in the kilns. We are currently at 17% but the 100% biomass fuels are flatlining. We are seeing competition from the power generators. We are seeing competition from the waste water treatment sector, whereby they are digesting some of their sewage sludge.

The ability for us to do that is getting harder and we are not seeing any incentives coming our way from RHI, and the EII package is tangled up in state aid. With the increased direct and indirect CO₂ costs, in the cement industry we can see that these additional taxes will be equivalent to the current GVA of the sector by 2020. If we lose the carbon leakage status in the EU Emissions Trading Scheme then we are seriously under threat from carbon taxes.

Q136 Dan Byles: Have you done any work on the comparative carbon emissions of the domestic industries in the UK compared to the countries we might be importing these products from should we lose them? My point is that it can be a false saving. Where it looks like we have saved CO₂ if there is an industry driven abroad but we are still using the same amount of that product, it is simply being produced less efficiently somewhere else, there is no net saving to the planet. Do you see what I mean?

Dr Leese: That is right. Last time I was in front of this Committee, I talked about global carbon accounting and the benefits have accounted for CO₂ properly. The Climate Change Act at the moment looks at the emissions we produce on our shores and we ignore all of the CO₂ that is imported in goods and services.

In the cement industry and the lime sector, we produce pretty much all of what we need. Cement is often regarded as having material that cannot be imported, but we have seen imports move from 3% to 13% in 10 years, and that is without a strong carbon price. With the additional taxation that we are seeing coming forward, particularly unilateral taxation

like the carbon price support, then we are not only under threat from countries outside of Europe but also our near neighbours.

Q137 Dan Byles: What are the real options for reducing carbon emissions from industrial heat? You mentioned biomass several times. Are there options other than increase pending biomass?

Dr Leese: Yes. With our cement greenhouse gas strategy, we focus on biomass, we focus on replacing the clinker, which is the energy intensive part of cement with other materials, but those other materials are becoming scarce because some of them come from the steel industry, some of them come from power generation. We are also looking at carbon capture and storage. For industries like cement—

Q138 Dan Byles: You are talking about industrial CCS, so CCS specifically aimed at the heavy industry.

Dr Leese: That is right for industrialists, yes. For cement and lime operators in the UK, 60% of the emissions in cement comes from driving CO₂ from limestone. When you burn limestone, you drive off the CO₂ and only 40% from the combustion element. In lime, it is even more; it is about 70% from the geology. So we have to look at novel technologies like CCS, but let's be realistic: they are a long way off and we have seen no support for developing those technologies, and there is a lack of capital to do that.

I was out in Norway a couple of weeks ago looking at the site for where there was going to be the first cement plant with a CCS capture facility on it.

Q139 Dan Byles: So if CCS is a long way off, if biomass ends up being deemed as not being a long-term solution for sustainability reasons—you know there is a big discussion going on about that—where would that leave us?

Paul Blacklock: There is another way, which a lot of people have not picked up on because it was only announced last week. National Grid last week announced that they are going to invest to make liquefied natural gas available for road loading from the Isle of Grain terminal, which will mean that big industrial users, like the industry that Dr Leese represents, will suddenly have access to natural gas. There will be a financial saving, because it is cheaper than the heavy fuel oil they are using at the moment, but you are talking about 30%, 35% carbon reduction. That has just happened in the past week.

Q140 Dan Byles: That would not be a suitable long-term 2050 solution for 80%, 81% burning.

Paul Blacklock: No, but while you are waiting for CCS and all these other things to work, there is a 30%, 35% carbon saving on the—

Dan Byles: That is LNG not CNG?

Paul Blacklock: That is LNG, liquefied natural gas. So for the large industrial processes like cement, like ceramics, some of the chemicals, anything that is sited off-grid at the moment could move to this technology in the very near future.

I have to agree with Dr Leese that most of the focus has been on providing incentives to move to renewables because that is the focus and DECC has been, “We must hit our renewable target,” so probably not enough attention has been paid in terms of providing or looking at other low carbon solutions, particularly on heat.

Q141 Dan Byles: What about the CHP side of making use of the excess heat that you use? We do not seem to be very good at that in this country.

Dr Leese: CHP is not appropriate for industrial technologies in the cement and lime sectors. We do not use CHP because we have no use for the heat. We can generate electricity from waste heat recovery, but at present the waste heat recovery in our sectors is beyond our economics, so we need some incentives to do that. Perhaps there is an opportunity there, albeit relatively small, because we do use the waste heat very efficiently to dry the raw materials that come in after they have been extracted from the ground.

Paul Blacklock: It needs a proper look, when you look at what has been achieved in places like Denmark where they have massive penetration of CHP, and with the Government’s ambitions in terms of heat networks. Also we heard earlier on that if you are going to try to do this with the centralised generation model, the cost of investment of trying to build all those power stations is phenomenal, and at the moment the jury is out on whether the bill payer or the taxpayer is willing to support that. Looking at a more distributed generation model, whether it is industrial CHP or right down to micro-generation in people’s homes, has to be part of the solution.

Jim Lambeth: There has been a problem for many years, going back in my history, with district heating schemes, which is effectively using waste heat. You have to have the point of consumption close to the point of generation. You cannot bottle this stuff and send it. It has to be directly fed into housing estates or commercial developments and so forth. Unfortunately, power stations and cement works do not tend to be sitting alongside housing estates—thankfully. So there is a problem there.

Historically, from my previous years of working, I had some minor involvement with district heating schemes and they were fraught with technical problems, literally, of distribution and metering and mains losses and all manner of things, which we just never seemed to get on top of. I remember classically there was a brilliant scheme in Edmonton, North London, using waste and coal, and in the end they ripped the whole lot out and put gas boilers into every property because it did not work. They were fundamental problems of how do you stop steam leaking out of pipes underground.

Q142 Dan Byles: Just very briefly because I am conscious of the time, back to Dr Leese. The Mineral Products Association said that the Government should provide incentives for waste heat recovery for recovering low grade heat, but what are we going to do with that low grade heat if we have this problem?

Dr Leese: Generate electricity.

Dan Byles: So that is the answer?

Dr Leese: You generate from that, yes, rather than use it in district heating, because generating electricity is more cost-effective.

Q143 Dan Byles: What conversations have you had with DECC about that?

Dr Leese: DECC are doing a piece of work right now with Ecofys consultants about energy, looking at the opportunities for heat recovery in industrial sectors, so we expect that report to come out pretty soon.

Dan Byles: We will wait with bated breath. Thank you.

Q144 Graham Stringer: Dr Leese, just going back to what you were saying before about how much it is going to cost you to move to a low carbon technology. The Climate Change Committee is involved as well, but it is clear that the carbon footprint of this country is increasing because we are just focusing on emissions and we are effectively subsidising Chinese imports into the country without a higher carbon footprint. Why are you not stamping your feet and shouting at the Government about this? I do not hear very much from industry. It is all about you reaching these emission targets, when they are counterproductive. Why do you not shout more?

Dr Leese: We try. We probably need to shout louder. I think you are right; we do have an issue with imported emissions. We have a cement market that is 35% lower than its 2007 peak and we have a very depressed construction market. We need to revitalise that construction market because we know that, if you spend a pound on construction, it is worth £2.84 in economic activity. We need, first of all, to regenerate our market and we need to focus on the responsible sourcing of our construction materials, so that we focus on locally produced, locally consumed materials for construction.

Q145 Graham Stringer: Mr Mason, when you were talking about strategy before, basically you were saying that to insulate the country's homes would cost about a third of a trillion pounds, in the roundest of round figures. Liberian Capital, among others, have made an estimate that the extra costs to replace our energy supplies at the moment by renewables and nuclear power is about, in round terms, quarter of a trillion pounds. In any future strategy, where do you think the balance should lie in investment between those two strategies?

Mike Mason: Between replacing our existing—

Graham Stringer: The extra costs of replacing our power supply at the present time. The extra costs, not just the replacement costs between that and insulating the country's homes to a much higher standard.

Mike Mason: It is a very difficult question because, by and large, in Committees like this and discussions—I am not trying to undersell the skills of the people—people tend to fail

to distinguish between energy and power. Power is what you need on a cold day; energy is the sum of what you do over the year.

If you look at our requirements for heat, for example—and it was mentioned in the previous committee—someone said 50 GW. It is more than that; it is 80 to 90 GW. Let's call it 100, because you have population growth, if you take 8,500 hours a year; but if you take 2,000 hours a year, it is four times that. On a cold day, it is 1.5 times that again, so you are talking about 300 GW before you have put heat pumps in.

Probably the most important thing that we can do is think about how we redesign our energy consumption system to spread those peaks. If you look at Germany, last summer they had negative wholesale electricity cost prices, and that is because they have acres of solar—forgive me DECC—which is generating at a time they did not need it and this vast amount of nuclear base-load. We are going to have to have a lot of new nuclear capacity and I do not know whether the public will accept 50 or 60 new nuclear power stations. We are going to have to do something like that.

What they are going to do in the summer is the difficult question. If you work on insulation and ground source rather than air source heat pumps, and you have mechanical ventilation and heat recovery, you can remove the peakiness from the system to a great degree, and that means that the economics of the system work much better. You cannot have a nuclear power station that generates 2,000 hours a year; it is a complete nonsense. It does ask the question, why are we subsidising solar panels, but I will leave that for another committee.

I do not have an easy answer, but it comes back right to the opening and most relevant question in this whole session, which is, what does the system look like and can we analyse the system so that we can make rational decisions about the allocation of public resources between generation and insulation? We have a wonderful resource in this country, which is offshore wind, which correlates almost directly, I guess—and I am guessing because the data does not seem to exist—with our heating load, and our heating load, as I said, is the biggest thing.

I do not have the answer, I would love to have the answer and we need to be doing some proper thinking, rather than just yet another little policy.

Q146 Graham Stringer: Mr Lambeth, you were talking about CHP before. In an earlier life, I represented a couple of domestic heating systems, combined heating power systems because nobody wanted them. When does CHP work and when does it not work, or where?

Jim Lambeth: I do not know to be honest, because you cannot run CHP on solid fuel of any description, so I have no experience. Sorry to duck that question.

Q147 Graham Stringer: It is just because you were talking about it before. Is there anybody else who would like to have a go at the question?

Paul Blacklock: I will have a go. You have certainly seen big developments on micro-combined heat and power in countries like Germany and Japan, which is not disconnected from the fact that they both decided to phase out nuclear. They are now looking at how

they can put in more distributed generation capacity. Where it is appropriate is obviously where you can use the waste heat. If you have systems that are designed to follow the heat load, because they are running the central heating system and then they will produce some electricity as well, again that will be at peak demand periods, and also where your peak power generation plant or your peaking plant, which is generally more carbon intensive, would be running. Anything that runs at the peak of the heat demand will displace the dirtier power generation. But as I said earlier on, with the right focus on more heat networks and in terms of new building development—and certainly we have seen a lot of it in London—it has to be encouraged and supported because it makes sense.

Q148 Graham Stringer: Where does micro-CHP sit in the pecking order of low carbon technologies?

Paul Blacklock: It is a problem child for DECC. We have talked at length to the heat strategy team and they say, “Well, it is not really heat,” so we have spent a lot more time now talking to the energy side of things. Again, they are looking at it now very positively from a point of view of increased distributed generation, taking stress certainly off the grid, but most importantly, looking at ways that will defray the sort of investment you would need in centralised generation if you do not have this capacity.

Again, there is a lot of focus from all sides in terms of trying to improve competition and the energy market. What better way of having competition than having 23 million homes or 25 million homes producing a proportion of their own electricity and competing direct with the Big Six. You have seen technologies coming through now that promise to be only £1,000, £1,500 more than a normal boiler, so we are not talking the traditional £7,500, £10,000, £15,000. We are talking about things that a lot of people could afford or, if they cannot afford it, it is economical to support them in that purchase.

These things are coming through. It goes back to what we said earlier on, that in 2008 the strategy was to decarbonise electricity and then put everything on electricity, yet in only four or five years we have had developments with the hybrid, heat pump, boiler bivalent systems. You have seen the gas absorption heat pump come back in. You have micro-combined heat and power. We are now talking about LNG supply to large industrial customers off the gas grid. These things were not known about or talked about a year ago, so this is a very fast moving environment, and from a policy point of view, you do not want to paint yourself into a corner.

Q149 Graham Stringer: Is what you are saying there is not a huge low carbon benefit from it, but it is getting a lot cheaper and more competitive?

Paul Blacklock: There is a carbon benefit, but because it is heat and power, it is not fitted neatly into one of the boxes. We did a presentation to some of the officials back in October, presenting a piece of work that our trade association had done in looking specifically at off-gas grid areas. At the end of it, the officials said, “That is very good but what about micro-combined heat and power?” They are still trying to rationalise where it fits into this picture. DECC is a very big organisation. You have the renewable team; you have the Green Deal team; you have the ECO team; and sometimes you have the power generation team. These units do not seem to communicate with each other because they,

quite rightly, are focused on their bit of the strategy. But often you end up with a strategy that is not joined up, and things like micro-combined heat and power, and probably combined heat and power, then fall through the gaps.

Chair: Thanks very much for that helpful evidence. If there is anything further you think needs expanding upon please get in touch, and we will get in touch with anything we have missed in questioning. Thanks again for your evidence, which was most helpful.