

Business, Energy and Industrial Strategy Committee

Oral evidence: Carbon Capture, Usage and Storage, HC 1094

Thursday 17 January 2019, Teesside

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Watch the meeting

Members present: Rachel Reeves (Chair); Stephen Kerr; Peter Kyle; Sir Patrick McLoughlin; Mark Pawsey; Anna Turley.

Questions 210 - 257

Witnesses

Andy Lewis, Future Role of Gas Innovation Manager, Cadent Gas; Dr Geraint Evans, CATCH Advisor, CATCH; Jonathan Briggs, CCS Stakeholder Manager, Oil & Gas Climate Initiative; Steve Murphy, Finance Director, Pale Blue Dot Energy; Pete Whitton, Managing Director, Progressive Energy; Peter Quinn, Head of Environmental Policy and Strategy, Tata Steel; Mark Lewis, Technology and Innovation Manager, Teesside; Professor Jon Gibbins, Director, UK CCS Research Centre and University of Sheffield; Andy Koss; and Lord Haskins

Andy Lewis, Dr Geraint Evans, Jonathan Briggs, Steve Murphy, Pete Whitton, Peter Quinn, Mark Lewis, Professor Jon Gibbins, Andy Koss and Lord Haskins

Q210 Chair: Thank you very much for coming to give evidence to the House of Commons Select Committee for Business, Energy and Industrial Strategy today. This is part of our inquiry into carbon capture, usage and storage. This is the first time that our Select Committee has taken evidence outside of London since I became Chair of the Select Committee at the end of 2017. It is a real privilege for us to come to Teesside and take evidence from you today in this incredibly important area both for our energy policy but also for our climate reduction targets. Thank you for coming to give evidence and thank you also to the people who have come to watch this session today.

I am the Chair of the Committee, Rachel Reeves, and I am the Member of Parliament for Leeds West. There are six members of our Committee here today. I am going to kick off the questions and then come to other members of the Committee. We have lots of witnesses here today, which is fantastic, but please do not feel that you need to answer every question because then we just will not get through the range of topics we want to cover.

For your local areas, and you represent a range of areas, what are the key opportunities and challenges for you with carbon capture and storage?

Steve Murphy: First of all, most of the things we are going to say today are going to relate to carbon capture and storage rather than carbon capture and utilisation for various reasons, which we can get into. I am representing the local areas within Scotland, I guess, or the east coast of the UK. From my perspective, which is transport and storage focused, the word "local" is a bit at odds with what needs to happen because of the geography and the geology for storage and the existing infrastructure.

To directly answer your question around the Scottish and the east coast area, the opportunities relate to reuse of redundant pipelines, both onshore and offshore, with a value of circa three-quarters of a billion pounds, which is a fairly significant contradiction right there. There is the very well appraised set of stores in the central North Sea, which is directly accessible from the St Fergus area, which has already had a lot of appraisal work and a lot of direct production work so that the sites are very well characterised. Import and export at Peterhead we would support, linking to Norway and their Northern Lights project, linking to Rotterdam, which we mentioned previously, and obviously then decarbonisation elsewhere here in Scotland. Because 30% of the UK's gas lands at St Fergus, there is a great opportunity to decarbonise some of that by manufacturing hydrogen. I guess we will get on to clean hydrogen production. With a third of the gas landing there, that is a great opportunity.



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In terms of some of the challenges, quite frankly reengaging industry and investors after the 2015 cancellation is problematic and challenging. There are certain aspects in Scotland that run a little deeper than that, back to the first demonstration competition in 2011-12 and even before that with the Peterhead Miller project. There is a lot of history there and a lot of investor fatigue or scepticism, and people rank political risk very highly. That is a bit of a challenge there.

Perhaps more specifically, the risk of decommissioning some of these pipelines that are now redundant. There are obligations, obviously, on the oil and gas operators to decommission in a sensible timeframe and they are obliged to do that. The risk really is that the CCS deployment takes such a long period of time for these pipelines to get decommissioned, so suddenly ultimately we have to spend another three-quarters of a billion pounds just to put in place what is already there and has since been removed.

Q211 Chair: How quickly do things need to move forward for you and your business?

Steve Murphy: Project Acorn, which is our project in Aberdeenshire, could be injecting CO₂ by 2023. It is appraised. We have the licences. We have the storage lease from Crown Estate Scotland. The pipeline we are in partner recruitment for right now, so it can move very quickly.

Q212 Chair: Thank you. Andy Koss, did you want to come in?

Andy Koss: Yes. We see a huge opportunity for CCS. I work at Drax power station. We have converted four of our six units to run on biomass and we are now trialling BECCS, bio-energy carbon capture and storage, at the plant. We are hoping by the end of this month to be capturing one tonne per day, so very small amounts, but if we can prove the technology we believe we can take this to commercial scale.

The opportunity for us is huge because not only could we create the first carbon negative plant in the world, but this could be the anchor project in the Humber region where the carbon intensity of our plant and across the Humber region is very significant. We support 6,000 jobs in the region. I know that across the Humber there are many more. As we talk about a move away from a fossil fuel economy into a low carbon economy, we think that there is a great opportunity to support jobs, a just transition in the region and create a negative carbon cluster across the Humber. I think that the opportunity there for us, for jobs, for the business and all businesses is huge.

On the challenges, I would support what Steve says. I think that it is great to see the Government's support of CCUS again. I worked on the White Rose project, which was cancelled in 2015. There was a pipeline that was approved all the way through to Humber and the south North Sea. That could also be used with the Teesside cluster as well, so there is an opportunity for the north as a whole. The key that we need now is we



have heard good messages and thoughts and pathways through to CCUS but we need some policy certainty and we need to start seeing the tools that the Government are going to use to support CCUS starting to come through.

We could also be at commercial scale in the 2020s. The Committee on Climate Change wants to see two clusters running in the 2020s and we believe we can meet that commitment, but we do need to see the investment frameworks in order to start making the significant amounts of investment required.

Q213 **Chair:** The investment that you have put into BECCS, your plant at Drax, you have funded all of that yourselves?

Andy Koss: We are working with C-Capture in your constituency.

Chair: Armley in my constituency, very good.

Andy Koss: Yes, they were spun out of the University of Leeds. They have secured various funding and we are in there in the CCUS competition. We are looking for some funding to help support the build-up of the work and the FEED studies. At the moment, yes, it is all our money but there will come a point where significant investment is required and unless we have that investment certainty it would be hard to make that investment.

Q214 **Chair:** I have one last question to you, Andy. How much more can you do without funding? Have you reached the limit?

Andy Koss: No. As I say, the messages are positive but I would say in the next year or so—the Government have said through 2019 we will see more certainty and start to see the policy detail around how they are going to support CCUS. That fits with our timetable. I think that any further delay in that will inevitably delay our plans and our commitments.

Q215 **Chair:** Does anyone else want to come in on this point?

Pete Whitton: Yes. In some respects, the general messages that are coming through I would totally endorse what has been said so far in terms of the things that matter and the challenges, that there is a firm market mechanism against which private industry can pay money. We do not have that at the moment, but equally the ship is under way again. Those of us that are a little longer in the tooth and have been involved in CCS projects before never thought we would see this day after the 2015 debacle.

Progressive has been involved in the Teesside Low Carbon Project here, which was one of the shortlisted projects for the last competition. We have also worked or are working at Humberside, south Wales and in the north-west at Merseyside. We have a broad appreciation of the different CCS clusters. Having picked up the scars from all the various competitions over the last decade, we set out to create a project that we thought would stand the best chance of being supported, in other words



one that was small enough but could grow to a material size, that was cost effective from day one, and which was doable. We have ended up, having looked at all the other areas, in the north-west creating a project called HyNet there together with Cadent Gas.

The reason that that is an opportunity, which takes me to at last answering your question, is that it is low cost for two or three reasons. One of them is it is one of the two places in Britain that have a substantial amount of CO₂ already captured. You have been to Billingham this morning and you have seen the ammonia plant. I am sure they pointed to the chimney and said, "Look, there is pure CO₂ coming out of there". We do exactly the same thing with the sister plant. There are two plants, so either of those plants gives you already captured CO₂. You do not have to spend money or time doing that.

You then couple that together with the fact that in the north-west there are gas fields that are just offshore, very close, and which are just about to close down and be decommissioned. That gives you two advantages. One is that you can repurpose the current equipment, which saves you hundreds of millions of pounds. The storage then can increment steadily from operating with gas and low energy to then save.

What this means is you put those together and you end up with a very cheap starting point. It does not cost you an awful lot of capital, it does not cost you an awful lot of revenue and you can make it work. You put that into an environment where there is a low-key version of the Teesside Collective in the north-west, which involves a dozen core companies and up to 30 companies who are all looking to capture their CO₂.

Q216 Chair: I am going to move on. I am going to take one more example from somebody before I move on to the next question. Peter Quinn wanted to comment.

Peter Quinn: I work at Tata Steel, if I could perhaps represent a steel industry view here. In terms of high-level message, CCUS—and "U" is important for south Wales in particular, which does not have access necessarily to storage facilities—is an absolutely essential part of decarbonising the steel sector. It is hugely capital intensive, even though in a steel sector context the figures show that carbon capture is relatively cost effective compared to other emission points.

The cluster concept is something that is absolutely the right way to go, we believe, and we are working with Progressive as a south-Wales cluster, where our main creations of emissions are currently, to try to understand what the potential is.

The big challenge, I think, will be finance. From a steel sector perspective—and this would apply to a lot of sectors—we are producing a globally traded material and we can ill afford to become uncompetitive. The real challenge for the UK is to develop secondary markets, become the exponents of carbon capture, utilisation and storage, and export that



technology in a brand new future. We do need an industrial base in the UK at which to test out the techniques.

There is a big opportunity for the UK both in terms of the decarbonisation side but also having a brand new industrial sector that it could export to the rest of the world. We do need a test bed for that to be done, and some kind of public support in terms of bridging that valley of death, high risk, high capital intensive infrastructure projects, will be needed.

Q217 Sir Patrick McLoughlin: I can follow on in a way from what Peter has just said to Professor Gibbins and ask him a little bit about what is being done to optimise the link between research and development, and ensuring that funding for innovation delivers the solutions needed by business. When Peter talked about a test bed and movement on that line, what sort of timescales would we be talking about there?

Professor Gibbins: If we are looking at links between practice and research, it is absolutely essential that there is a good exchange of information in both directions. It is often said about research that the important thing is not the answers, it is the questions. If you get the right question from the right person and you provide an answer, then you immediately get impact.

The caution I would say is on the previous two competitions, particularly the last one, there was an absolute embargo on any discussion and any information coming out. That seriously affected any planning of research to further the technology. There is a very good case—

Q218 Sir Patrick McLoughlin: Sorry, when you say there was a banning, sharing between who and where?

Professor Gibbins: Between the project and anybody. It was on the basis of avoiding collusion, I think, between projects.

Pete Whitton: If I may because we were involved, there was a competition protocol that prohibited participants from talking. We can talk about collaboration when it is wrong, but that was critical.

Professor Gibbins: Yes. There were a number of years where people were realising that further information was needed but they could not tell anybody about it. Nobody could prepare for that.

There was also subsequently a problem that the FEED studies were obliged by DECC, as I guess it was then, to deliver key knowledge transfer deliverables. Those are good in parts, but in a lot of the parts the information is redacted on the basis of it being proprietary technology, which is fair enough but an awful lot of the interesting bits are redacted. Again, there is no information coming out on problems and there is no information able to go in to address those problems.

If you want to get good innovation, there is a very strong case while these projects are getting a lot of Government funding to come up with



ways of enabling both research and also input from multiple organisations on the technology. That is feasible.

Having done that, particularly with a number of the technologies we are looking at and with the research base we have in the country—the UK CCSRC has 300 academic members—we can do good things. Like I say, you have to get the right questions to the right people—we have the right people—and then you can get the answers out and you can start to see cost reduction. I can send you some more information on a model for essentially open access to publicly funded projects.

Q219 Sir Patrick McLoughlin: That would be useful. There are presumably no barriers to you working together at the moment because there is no competition and the five areas are able to work together. Is that happening?

Professor Gibbins: Yes, I would say we have had reasonably good interactions with all of the areas. What I would say is that we are the UK CCS Research Centre and in a sense my area is the whole of the UK. What we will find going forward is if we are going to deliver on 1.5 degrees or anything like it, then the whole of the UK will have to be net zero, possibly by the middle of the century. I was just having a check and about half of the UK's emissions come from regions that aren't immediately associated with a cluster, a lot from Thames and the south-east. You are going to find that CCS spreads out. The UK is a relatively small country and this is not impossible.

Obviously, you are starting with clusters but you need to think about the bigger picture very soon. That is what academics are doing. We are thinking a lot not only about the very first projects but how you get through to net zero and, indeed, beyond. The Committee on Climate Change said that we will need of the order of 50 million tonnes a year of negative emissions just to get to 80%, or even more, so it could well be that negative emissions is the biggest single source of CO₂ for storage.

Q220 Stephen Kerr: I would like to turn to your thoughts on Government ambition and Government policy. I am going to ask a very simple question. The Government's plans, as you are aware of them and as announced in the green energy strategy document and again last year in the CCUS plan, are they sufficiently ambitious and, if they are not, what does that imply in terms of the forward progress of CCUS?

Dr Evans: I think that the CCC gave a clear ambition of 60 to 100 million tonnes of carbon being captured by 2050. If you go on that basis, your rollout in the 2020s needs to be significant, so probably in the region of 10 million tonnes by 2030, to stand any chance of reaching that figure in 2050. At the moment, I don't think the Government ambition is great enough, but I would not understand why Government would want to limit their ambition at this moment.



They have kicked the whole thing off again in the Clean Growth strategy. I don't think they should be limiting it to one facility by 2028 quite at this point. That decision has to be made possibly further down the line. We are all driven by cost and providing projects at least cost for highest value, and I think that until we can fully see what the cost is of the projects, which I think is lower than a lot of people think, especially compared to the previous two projects, we should be setting an ambition after that rather than now.

Q221 Stephen Kerr: The implication of not having that sufficiency of ambition is what? What is the knock-on of that?

Dr Evans: If your ambition is 10 million tonnes—

Stephen Kerr: Other than missing targets and things?

Dr Evans: What are the consequences?

Stephen Kerr: Yes, the carbon budgets and things, other than that what does it mean for the investment?

Dr Evans: Certainly from a Cadent point of view, we cannot keep supporting these projects that something may be just around the corner at any given point. At some point we do need Government to make a clear stance. They have given warm words that they do support CCS, but 2019 is going to be a very important year to show that ambition that gives industry and the private sector confidence that something will happen in the 2020s. Yes, this year in particular is going to be very important.

Jonathan Briggs: I said this slightly earlier. My view is when I think of the ambition I am looking at the longer term goals, targets, and so on. First, the ambition is to have CCS deployed by the 2030s and contributing at scale. The key is to make sure that the ambition is matched, because otherwise the ambition is tied back to goals, quite frankly—as Jon was referring to—in terms of getting to net zero by the mid part of this century. If you do not meet your targets and ambitions, it goes without saying that your greater goals are not going to be met either.

What is key here is that, if you want to be contributing at scale by 2030, CCS is a long-term business. From permitting these types of projects to construction, these are five-year construction projects, two years to permit, so you need to be building in the mid-2020s in order to be basically contributing at scale by the 2030s and, therefore, being able to actually meet your longer term goals.

My view is that the targets are ambitious enough; the key is to make sure in the near term you are starting off where your actions are in support of those long-term projects.

Andy Koss: I think that you asked specifically what products will be next. I think that there is a great export opportunity as well. As Jon



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Gibbins has said, the UK is in a leading position. We have an awful lot to work on with CCUS. I think that if we do not fulfil that ambition there is a danger we could fall behind and we will miss that export opportunity.

Mark Lewis: The other opportunity that needs to be mentioned is the import opportunity. By having carbon energy we will take advantage of the geology, which we know exists in the North Sea, to compete with the Norwegians as somewhere where people can put their CO₂. Where is Rotterdam going to put its CO₂? It might put it in Rotterdam, but it could put it in the North Sea on this side or it could bring it into ports on this side and put it there. There is value there as well, which we must not discount. It is potentially a big market for us.

Q222 **Stephen Kerr:** That is all at risk if we do not translate ambition into actual actions with milestones. You have mentioned a couple of phrases and I just want to test my understanding here. We asked Claire Perry what these words mean and we were not entirely sure that we got a clear answer. "At scale", what does that mean?

Jonathan Briggs: "Scale" means anything you are putting in place that has the ability to store CO₂ at 10 million tonnes or 20 million tonnes per annum, something of that order. What those numbers are I am not actually clear about but I can check.

Stephen Kerr: It would be worth you doing that and telling us, unless anyone has them.

Jonathan Briggs: "Scale" is not half a million tonnes, a million tonnes here, a million tonnes there. To be quite honest, "scale" is 20 plus to make a difference.

Professor Gibbins: It has to make a noticeable contribution to total UK emissions.

Q223 **Chair:** Do you think, Professor Gibbins, it is 20 million tonnes?

Professor Gibbins: If you think what the total UK emissions might be by the mid-2030s, I guess 200 million tonnes, 10%, given that we are on a very strong downward trajectory there towards net zero, yes. If you say you are cutting 1% of your emissions, that has no scale, but 5%, maybe 10%, you are starting to get to numbers that are significant.

Unknown: If you want cost reduction, then the economies of scale apply to that industry. The more targets achieved the better.

Q224 **Stephen Kerr:** You are going on to the second thing I wanted to ask. In the Clean Energy Strategy document it says that the ambition was to have the option to deploy CCUS at scale during the 2030s, subject to costs coming down sufficiently. How do you get the costs to come down?

Unknown: I think I answered that this morning.

Stephen Kerr: Yes, you did.



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Dr Evans: In 2015 I, until very recently, worked with ETI. They highlighted that to deliver the savings in the energy system—that we were looking for to deliver a low-cost future energy system for 2015—you would need around 10 gigawatts of capacity, so electrical capacity, by 2030. That is available to look at on ETI's website in one of their Insights papers. You asked about the question of scale. When we looked at it in 2015, around 10 gigawatts of electrical capacity—

Q225 **Stephen Kerr:** Of electrical capacity, but you were talking about pounds?

Professor Gibbins: Yes. "At scale" means different things for different things. First, "at scale" is making a significant difference to the UK's national emissions, and you know what that is. That is tens of millions of tonnes to make any effect. That is also the sort of scale where you get economies of scale in transport and storage, and that is basically the way you will get the costs down for transport and storage.

There is perhaps also a bit of a debate about what you would need to do to learn by doing from capture technology. For that you need at least one unit that is of the right size. It is at a scale where you will get economies of scale for a power plant, or for an industrial application. That is of the order of 1 or 2 million tonnes a year per unit type of thing, I think one would say. You need to do that. Again, if you try to build smaller units—the Ceompetition was constrained in size—you will not even be learning about the right scale.

What you then need to do is to progressively build more of those units with all the research that we have been putting in between, provided we can get access to the information and feed it back in, and then you build up the market and you gradually develop a market that is at scale, which is where you come to the order of 10 gigawatts of power capacity and something significant on industry and something significant on hydrogen as well.

They are different "at scales". There is commercial scale for projects that are different sizes for different parts of the chain. There is a scale for the industry. Don't expect an industry to deliver cost reduction without a market. If you go back to what was on offer for wind, they were imposed the challenge of getting low cost but they were also offered a prize if they got it. If all you give is effectively a stick and no carrot, don't expect the donkey to go very far.

Peter Quinn: On this moot point about what "at scale" means, I just wonder whether it also means something about whether it is a bit ambiguous in terms of geographic spread of deployment, and that is something that is important. We could achieve 10% of UK emission reductions in one cluster. I do not think that necessarily is the way that things should move forward. I think that we need to see some kind of even geographical spread of the emission reduction. That would be a useful thing to build into the concept of "at scale" as well.



Stephen Kerr: That is very helpful.

Professor Gibbins: I 100% agree. You should also when you are building that be aware that all of the clusters will help other clusters, certainly the adjacent ones. The UK effectively is one cluster eventually, and certainly even in the shorter term it is very obvious that it is two clusters, the east coast and the west coast cluster. If we get to the point where it is clear that whatever is built first helps to build out other clusters, which it does—I think that is very obvious; it de-risks them—then it goes away from the stupid idea of having another competition.

If I would say anything really strongly, I have been hearing rhetoric, perhaps unintentional, perhaps automatic, out of various bits of the administration on CCS that suggests that people have habituated to running competitions. If they run another competition, industry will get déjà vu all over again and run away from it and we will get all of the problems that we had before. This cannot be a competition. This is decarbonising the UK and it is working together. The fact that you see all these people together tells you what people want.

Pete Whitton: It is not difficult to agree. The concept of “at scale” we started this on the level of ambition. The level of ambition at the moment is one project perhaps operating before 2028. Ambition is about maximising the benefits of CCS, which happens in two ways, one by decarbonising at low cost and, secondly, by protecting the industry and creating gross added value. In the industrial clusters, all of the industrial clusters, there is a significant amount of gross added value that happens.

At scale is not about a number so much as about creating all of those clusters. Why pick on one and ignore the others? They will not be there to be looked at unless you do something about it earlier. Being able to deploy at scale in the 2030s, in my mind, is having several different clusters under way.

The question then is: what is the strategy for doing that? How do I do that at minimum cost in a way where I can get something that gets the economies of scale that people are talking about and everything else, all of which is very valuable? Economies of scale are, in the CCS context, as much about utilisation of capital assets as they are about anything else, and you can do that very cheaply.

Q226 **Sir Patrick McLoughlin:** I have a very small question. I heard what you said about competitions and no more desire for any more. Is there any figure as to how much was spent on trying to get ready for the last competition, which was subsequently cancelled?

Professor Gibbins: The National Audit Office said what the Government spent, didn't they? I don't think we know what the industry spent?

Unknown: Hundreds of millions.



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Peter Whitton: In the Carbon Capture and Storage Association I think we calculated £350 million, but please do not take that as gospel.

Q227 **Chair:** Thank you. If anyone wants to get back to us later, in private if you want to tell us confidentially how much your business spent or how much your cluster spent or that we could use in public, either of those would be very useful.

Andy Koss: Can I make a comment on the costs, Chair?

Chair: Yes, just briefly, and then I want to come back to Jonathan Briggs.

Andy Koss: The challenge is for the private sector but I think that it is also for the Government as well. There are funding mechanisms. We heard today about new nuclear and the regulated asset base model for maybe around transmission and storage. There are ways and mechanisms that can make the costs of deploying CCS at scale cheaper. There is a challenge to industry and all of us would accept that, but Government can do their part, too.

Q228 **Chair:** Thank you. That is one point that Stephen might come back to, but let me just bring in Jonathan Briggs.

Jonathan Briggs: I have two quick points. One might be slightly contentious. The first thing is that we do collaborate together; there is no question. We are all in the same place. Formal competitions are not the way to go. You have heard that today.

However, I would say the following. Somehow the challenge is going to be collectively that the right projects should go first. The key is that something has to be deployed, as I keep saying, in the near term in order to build up, otherwise you just won't get to these long-term targets. We have to acknowledge that. There is a natural timing that exists out there and the challenge is: understanding projects, looking at what is happening, the right assets, clusters, investors, and trying to sequence them.

The other thing I was going to say was Pete is right. In any operation, the more opportunities when one node is down you go to another, the more you basically work away from a point to point operation, in other words multiple sites, multiple storage opportunities, the better your system is. Long term, that has to be the right way to go. I do think that near term the challenge is making sure that the sequence of projects is right because the long-term ambition means that all these clusters have to be built up.

Q229 **Stephen Kerr:** Let's go back to what Andy was talking about there. I am interested to hear your views on what makes it easier to secure investment in CCUS.

Andy Koss: The key is long-term investment certainty. Therefore, anybody with interest in infrastructure or the energy sector requires large



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amounts of capital upfront and then there are the revenue flows after that. Obviously, the more security you have over that future revenue earning stream, the lower your cost of capital, the lower the risk premium, the cheaper it is to make that project work, and the cheaper it is for consumers. I think that the CfD mechanism, for example, has worked very well in driving down the cost of offshore wind because it gives that certainty that enables people to drive out costs and drive down the cost of capital for those projects.

I worked on the White Rose project. This was a combined power plant and transport and storage network project. It was all wrapped up into one and where the commercials fell down was the interaction between the two. If the pipeline is down, then if I am now capturing CO₂ I have nowhere for that to go, so that has to be the risk for the transport and storage provider. Similarly, the transport and storage provider says, "If the power plant is not making any CO₂ to capture, you need to pay me a fee anyway". There was this constant battle between the two and eventually that was one of the challenges.

What came out of the taskforce fairly soon after that was let's separate the two. Any pipeline network, if we look at the electricity market, the gas market, is put under a regulated asset base. There is an investment. We give you an agreed return, so again it is very cheap to invest in. I think that most people would recommend that we take a very similar mechanism for CCS. By segregating that from the power plant or industry it makes it then much easier to invest in individual projects that then hook up to that pipeline.

As I say, I think that a lot of work has been done to investigate how we drive costs down for networks and projects, and we need to deploy that. The Government are now looking at for nuclear the regulated asset base potentially as the only way forward to see further investment there. We would say that should be extended to the CCUS network.

Q230 Stephen Kerr: Does anyone have anything different to say?

Steve Murphy: Yes, different in a couple of ways. It is quite interesting that the witnesses today are mainly from the finance community, as far as I am aware. At the summit back in November, there were some representatives from the finance community, predominantly Société Générale, who have been involved in CCS for a long time. The message that Allan gave was quite clear, "Nobody is talking to me about carbon capture and storage and utilisation". If there really is the commitment that the Government have to achieve that ambition, then people need to be talking about how they are going to finance these projects to achieve scale now in order to have them operational and the construction ready for the mid to late 2020s, so that we are at scale, whatever that means, in the 2030s.

One of the positive things about having a competition, the previous demo 1 and demo 2, is that that provided a revenue model for the investment.



In demo 1 it was essentially a project contract, a PFI-style arrangement for collecting payment. In demo 2 it was a contract for difference style of arrangement. Competition gives them certainty about what the revenue model is. I am not afraid of competition, don't get me wrong, but that is just one advantage.

The big bust there is that there is no revenue model, so why would anybody invest significant amounts of money? People will invest at the moment at speculative R&D type levels, £1 million, £2 million, £3 million, that sort of level, but £100 million, £200 million, it is a bit problematic when you start to think about the Industrial Strategy Challenge Fund with the match funding. That is all very good but what next? How can I assure investors? What is the feasibility of a return?

Q231 **Chair:** Can I bring in Dr Geraint Evans? Did you want to say something?

Dr Evans: No, I would just agree with the revenue model but also no governance structures for the pipeline and how that would be tied up, so all those things.

Q232 **Peter Kyle:** Lord Haskins, it would be interesting to get your take. We have spoken a lot about cost reduction. Do you think that the policy framework at the moment is incentivising cost reduction?

Lord Haskins: The one I have most experience of is offshore wind where there was a feeling that maybe the Government had been too generous in the early days. The incentives to reduce the cost of offshore wind have certainly worked. Offshore wind has come down by nearly 100%, from 150 to 75, something like that, and there is more to come. It requires investment and for the investment the revenue has to be there.

The thing that we all talk about these days now is certainty or uncertainty with everything that you guys are up to. Anybody looking for certainty in this day and age is looking for too much, but there has to be some. What I am looking for as an investor—and I am here not as a specialist on this but representing the 11 LEPs from the north of England, where we are putting together an overall energy policy for the north of England, the argument being that 200 years ago the industrial revolution that the world now has benefited from started with energy in the north of England. We go back to the thing 200 years later and we say, "Where are we going now?"

We are working together on this with a view to an energy summit in Hull for the north of England in October—Claire Perry has very much endorsed this—to try to get Government policy into a coherent basis for everybody in the industry to understand and for the public to understand as much as anything else, including conservation, domestically and industrially. It happens that the Humber has every aspect, good and bad, about energy. We are the largest polluters but we are also the largest creators of energy.



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I am going to listen to how this can fit in because I was on the Regional Development Agency when this was started in 2007 or 2008. It seemed to me to be a very attractive proposition, rather expensive but a very attractive proposition. I am delighted that it is back on the agenda now. It seems to me that you are all talking in a more practical, business-like way about it now and I hope it comes to something.

The cornerstone of the northern economy is energy, and I keep saying to people there are only two things Governments do not dare ignore. One is food and the other is energy. Without them, the lights go out and people go hungry. There is a danger of both if we are not careful in the next few months. We had better sort it out.

Q233 Peter Kyle: We hear you. Professor Gibbins, I guess the consensus here is that we need economies of scale and we need long-term stability and security in policy. Are there any signs that the proposals that are coming out of Government at the moment are delivering on those two things or have the capacity to deliver on those two things?

Professor Gibbins: I think that despite some of the comments everybody here is actually feeling very pleased at the effort that Government are putting in on CCS at the moment, and I have to say particularly Claire Perry. One of the biggest risks to the progress of CCUS in the UK and, indeed, globally, having seen her in action at Katowice, is that Claire Perry is moved on to something else before CCUS is set in a good direction. That really is a big risk.

The projects that we've got have all that is required to form the different parts provided they are encouraged to do the right things. Again, going back to the previous competition, there were some very narrow targets and very rigid targets that I do not think rewarded projects adequately for doing things like, for example, encouraging cost reduction through technology across the industry, encouraging the growth of other projects, encouraging collaboration between projects. They just were not there in the benefits.

What we have now is we have CfD. You could give a CfD to carbon capture and storage tomorrow. I personally think it ought to include some flexibility to take advantage of the unique selling proposition of CCS power, which is that you can save money when you do not need it. All of the other low-carbon technologies cost you the same whether you want them or not. One of the big problems is actually going to be which of these subsidised electricity sources we need to turn off. CfD is there. It could be adapted to use. We are getting close to a regulated asset base in other industries.

There are a number of things to do. There are probably some industrial subsidies that could be done at a smaller scale to demonstrate feasibility of technology. There has to be some flexibility so that in the shorter term we use the mechanisms that are available and be prepared to transition



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them into longer-term, sustainable routes. You have seen that in a lot of industry.

So yes, I think that we have the beginnings of what is required. Yes and no, I think they are suitable but you have to be prepared to recognise and value the bigger picture aspects, and also no, in the sense that I don't think what we have is exactly right for the long term. But if we wait for what is right for the long term it will be 2030, 2035, and we won't have got the start. It does start with individual projects. It does start small, but it has to. It has to go one at a time, but provided that you realise what is needed to make those first things, the value will come. That is fine. That is just progress.

Q234 Stephen Kerr: I have a fairly quick follow-up question. You talk so well of the Minister of State, but my question is to Jonathan. What evidence have you seen or experienced at the Treasury that will make the wheels turn and turn the lights on? What evidence have you seen that the Treasury is behind these ambitious plans?

Jonathan Briggs: First, the process involves—as Jon was just referring to—industry and Government together with the task force that has come up with recommendations that are being followed through. To your point, Treasury has been involved and been present in some of these discussions.

Q235 Stephen Kerr: Some?

Jonathan Briggs: Some of the discussions, I would say. I don't know if anyone wants to tell a different story there. I would say that they are not vocal and you would not expect them to at this point come out and say, "Yes, this is all perfectly financeable in some way". There could be more. They have been present. That wasn't the case in the past, I think. Certainly, from our perspective we take that as a positive sign. Similar to the point on ambitions and targets, you have to see it through and seeing more from the Treasury would be a good thing.

Mark Lewis: I was going to say from the point of view of the Teesside Collective, we have meetings with Treasury as well. We have felt we have always had to re-educate them because they did not understand what the benefits of this technology were. That engagement is something that has to be enhanced. The Treasury has to be involved with this.

Pete Whitton: Can I go back to the cost reduction question?

Chair: Shall we just let Jonathan Briggs finish on this point, then?

Jonathan Briggs: The conversation with Treasury is different. There is one thing I should add. In the past CCS has always just been about a cost. The reason why I think that Treasury is starting to be present is because the conversation is about the benefits of CCS, the fact that it is a new industry, the fact that there is a position that the UK could take. Again, remember I am representing oil and gas companies who want to



see this happen but have other opportunities worldwide. The UK is a good place to be right here and now, so there is that benefit that I think they are starting to understand.

Pete Whitton: One of the things I was going to say in the context of cost reduction is that historically it seems to become the mantra: how do we reduce the costs of CCS? The other side of the equation, which Jonathan has just said, is about the value for money that is a primary driver from the UK plc point of view, from Treasury's point of view and from everybody else's point of view. That is one part of it.

The other thing is when we talk about cost reduction there is a history of CCS only being applied to power. Again, it was about cost reduction in power. If we look at where the markets are where CCS can provide the lowest cost of carbonisation solution, then industry is one of them. Fifty per cent of the emissions from industry come from heat. Were you to do a similar thing to this in the north-west, we can take you and show you a boiler operated on hydrogen. You can operate on hydrogen now and you can take out a lot of industrial emissions.

If you go to the equivalent, if you go to wherever you have been, the CO₂ is already captured. This is already the lowest cost of abatement. It does not need to be reduced any more. It is the lowest cost already. There are market sectors where CCS applies where cost reduction is not the issue. It is a matter of delivering it so that you can get the benefits of it. It is not about cost reduction. The power market is different. We should be asking a different question.

Then you say, "Where else do I need to reduce costs? Yes, I need to reduce it in the transport and storage". I started off in the introduction saying you go and you look and say, "How do I produce the transport and storage system that is not very expensive, that is cheaper?" and that is the question that you look at. You can do that to a degree. For the cost of one of the projects that we were looking at in the old competition, you could produce three projects now if you ask the right questions. I have a feeling that it tends to be this mantra of cost reduction because we have had power in the past. It is not the right question, in my view.

Q236 **Mark Pawsey:** I want to stick with costs because that seems to me the critical barrier. The technical arguments seem to have been dealt with and there is a perception that CCUS is expensive. We have a think tank saying that the cost is prohibitive. Peter Quinn told us that it is hugely capital intensive, while Andy Lewis told us that it is lower than you might think. How much would it cost to get a project up and running? I am interested in whether those advocating CCS should be arguing for a big, major project where the cost per unit will be rather less, or should we be looking at a pathfinder project just to explore whether it is viable, when, of course, the costs will be per unit higher? Andy, what is your view?

Andy Lewis: I think that you have to start to look to deploy projects between now and 2025. That probably has to be a minimum of two



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projects and the ambition should be higher if we believe the cost is as low as we think it is. The cost of the projects in 2015 was significant. The industry has taken the lessons from that and realised that that level of money is now not going to be on the table and have driven down costs for the projects as far as we can. We are talking significantly lower than that to get a full-scale CCS project up and running.

Q237 Mark Pawsey: Can you give us a number or give us an indication of what the UK needs to spend, whether it is Government funded or whoever, to get a project under way?

Andy Lewis: Well under half a billion, £500 million. That is full chain CCS project.

Pete Whitton: The previous project, Teesside Low Carbon, which was here, was between £1.5 billion and £2 billion. For half of that amount of money, you could get maybe three projects if they were done correctly in different clusters.

Q238 Mark Pawsey: As technology improves, are you saying to us that if we hold off in a few years' time the costs may have reduced further?

Pete Whitton: That is not a technology statement. It is a redefinition of the problem statement. It was a competition run against a very tight spec, "Please produce a power station that does this, that and the other" so you design something to that. That is the way the numbers came out. All the projects came out at those sorts of numbers, that sort of order. If you don't do that, if you say, "My mission is to introduce CCS at the lowest possible cost" you do it in a different way. If you structure things in a different way, you could get three for the price of one. You could get a lot.

Q239 Mark Pawsey: But everybody does want to do it for the lowest possible cost, don't they? We do not want to be paying any more on our energy bills and businesses do not want to be bearing any more additional cost than is absolutely necessary.

Pete Whitton: Absolutely, and the industry takes that on board and is working on that basis.

Andy Koss: To give an example at Drax and the White Rose project, just to be clear, we were capturing 2 million tonnes with a brand new, high spec technology project. We were also including within the project a 17 million tonne pipeline capacity. The idea was that the first project would be more expensive, but that was because the entire infrastructure was being included. I think that is the number that the Treasury baulked at in the end, but there is a recognition that second and third generation projects would come down.

At Drax, what we are looking to do is reuse existing kit. To Pete's point exactly, we have taken on board that challenge. If we can use existing infrastructure, which has been well maintained, we have the entire grid



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infrastructure sitting right next to the project. The North Sea is the perfect place for this carbon to be stored. This reduces the cost. We are just about to kick off a FEED study. Hopefully with a successful Government competition we will have much greater clarity on the cost, but it will be significantly lower than when we first approached this four years ago.

Q240 Mark Pawsey: I am going to ask how much Government support you will require in order for that to be viable.

Andy Koss: We do not know yet because we do not have the numbers, but it does not necessarily need Government subsidy or support. If there is investment in transport and storage systems, as I mentioned—maybe it is a regulated asset base that just keeps the cost down—we then need to look at the cost price of carbon long term. If we have a high price for carbon, we need support. Then we work through the numbers in terms of the investment, but it will be significantly lower, I would say half the cost of where we were looking at the White Rose project four years ago.

Q241 Mark Pawsey: One of the reasons why we are in Teesside is the opportunities for industrial CCUS. There are lots of parts of the world where these projects are not even being considered. Of course, that means that products manufactured here, if they have to pay an additional amount to fund the carbon capture and storage, they are going to be more expensive. Why should businesses buying the products that are manufactured here be willing to pay more for products that are manufactured in an environmentally friendly way? Are they prepared to do so?

Peter Quinn: There is a distinction to be made between power generation and its ability to bear the cost of investment in infrastructure and that of industry. We have talked a lot about uncertainty or certainty in terms of future policy.

By the way, the region we are in at the moment is absolutely a case study in what does happen in the steel industry in the UK and what can happen to other parts of the steel industry. It bears the cost of carbon and it is a real cost. There has been concern over the years—since 2005 when the EU tests came into being—about windfall profits for ArcelorMittal or for Corus or for Tata Steel, but primarily it was the financial crisis that caused steelmakers to vastly reduce their output.

We have gone way beyond that now. We are in a position where it is an absolutely huge cost on its own of steel. One thing we have to be very careful about is not to say that the solution to overcoming this capital hurdle is for there to be clearer carbon pricing for steelmakers. It is an extremely well-rehearsed argument and one that possibly you do not have the stomach to hear me go on about, but for globally traded materials you cannot take a carbon price that is not being borne by all the carbon-constrained economies in other parts of the world, and that is a big challenge.



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Just to go back to your particular point, one prize that could be available in the future is that you could have a situation where there are incentives, either through public procurement, eco-design, and barriers to entry to certain markets, where you say we will only accept entry into that market by products that have a particular carbon footprint.

Q242 Mark Pawsey: But who is going to specifically put that requirement in? The public sector, perhaps?

Peter Quinn: The Crown Commercial Service could say that any publicly procured steel, or any material, needs to meet some particular requirement. We just have to be careful. So it is a prize. It is something that is a policy opportunity in the future. I don't think we are ready for it now, but I am just thinking about it from the methodological problems of policing the carbon intensity of components and products at the border. It certainly is a prize, and it is something that could be a mechanism for incentivising the uptake.

The key point I would make is carbon pricing levels, £80 per tonne carbon price, will overnight cause the steel industry to cease to exist in the UK rather than cause it to invest in carbon capture, utilisation and storage.

Pete Whitton: Could I make the other point about industry that the purpose is to reduce the total emissions for the UK? The cheapest emissions to reduce are the ones in industry, so everybody in the UK is gaining if you reduce emissions in industry. The cost of capture in the steelworks—and we did all the work on the steelworks that closed here—is really very low.

Q243 Mark Pawsey: You would focus on the industrial sector before looking at energy?

Peter Quinn: I would. I would focus on the industrial sector, where it is the cheapest way of taking CO₂ out of the system and everybody is gaining from that. The gain is the social good, so it should be spread in some way, not loaded on the particular industries involved.

Jon Gibbins: Just very, very quickly, this question about: what does it cost? I think the key question is about how you pay. We have seen, for example, that for renewables for which is electricity, mainly, and a lot of other carbon saving measures, if you put the cost down per tonne of carbon, it is all over the place, with some very, very high numbers, hundreds of pounds per tonne. But people do that because they want to incentivise other actions, they want to make preparations.

We were phrasing the discussion in terms of the capital investment. A number of the support mechanisms do not involve an upfront capital investment. Just at the moment, for example, you might be looking at some sort of stimulus activity. If you can get people to invest in the country, invest in capital projects on the basis of an income stream starting in five or 10 years' time that could be good.



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You really have to say, "If I am paying by this method, what would it cost?" or, "If I am paying for this product, by this method, what would it cost?" and you get different answers, perfectly reasonable.

Unknown: The cost depends on the risk. You cannot have asymmetry there for things that happen, which is the situation we are in at the moment. If a party only wants to pay a low price, they need to accept the high risk and vice versa. You cannot take the cost—that is all I am really saying is that the cost conversation needs to be cognisant of what risks one is willing to take in accepting the counterparty's document.

Q244 **Peter Kyle:** Is everybody agreed that the funding mechanisms of carbon capture should be separate from those of transport and storage? There is unanimity?

Steve Murphy: Again quite quickly, in the longer term, I think that is inevitable. The two businesses are very different. One is infrastructure. That is probably a small number of players; whether it is industry or power, or whatever; many, many players and also capture of carbon.

In the first few instances, I don't know what the question actually means, I forget how he mentioned it, but it will have to be point to point, initially, in order to get a cluster and probably, in those first instances, looking at some kind of full chain project, perhaps longer, the pathfinder nature that Mark was alluding to earlier. The difference in costs, or unit costs, that you might see, you might find the initial capture point might be quite small, and it is bearing the costs of the infrastructure, which might be £100 to £150 per tonne but when you utilise the infrastructure more fully, you get a 90% reduction on unit costs, effectively, so big prizes.

Q245 **Peter Kyle:** Yes. You mentioned the regulated asset base a moment ago, Andy. Is it the assumption that that is the best approach for transport and storage?

Andy Lewis: It is only an assumption. It needs to be investigated, basically. The regulated asset base has been used to fund other projects, in water sector, for example, Thameside, where we are using it in the gas sector; it is a relatively well-trodden path. This current price control finishes in 2021 and goes on to 2026, so the negotiation for that price control is happening now. If we are to seriously look at that as an opportunity that would need to be done now, in order to use it from 2021 onwards. There is a window of opportunity there that will be lost until 2026 if we don't use it.

Andy Koss: There is obviously the task force, which was a cross-industry body involving finance and also lots of people involved in these projects, that was the recommendation that they came down to.

Steve Murphy: The thing is I think there was a recommendation to look at that. There are perhaps some charges associated with buying RAB(? 1:07:59) to offshore transport and storage. If you compare it to Thames Tideway, for instance, a £5 million project, or Hinkley Point, those



enormous, very long-term projects, offshore infrastructure—particularly the ones that Peter and I are talking about—are in the order of £200 million, £300 million. You have to question whether RAB is completely appropriate for that scale of project.

If we are looking at bigger projects, and we reflect what has happened offshore over the last 60 years, which has been phased development to big, complicated projects, do the pathfinder, expand at the right moment in time—it is just a different perspective.

Q246 Peter Kyle: We need to keep moving forward in the conversation. I am sorry, but we do have to cover a lot of ground here. I know you did not read this stuff and you have so much stuff to download. You are always very welcome—anything you think you have not heard—you are very welcome to contact us. We do read it and include it in.

Moving forward, though, as the industry moves forward and hopefully we can get cracking with this, there is going to be a lot of innovation that comes out of this. Are we well placed at the moment to capitalise on the export market for this technology? Or do we need to do more? Or be thinking differently? As Government develop policy, should they be thinking with that in mind? And are they? Or are they not?

Pete Whitton: Can I simply say that we need to get some projects off the ground. We have been talking about it for 15 years.

Chair: We have definitely heard that point. This is about the benefits of all of this, so how do you persuade Government to go ahead with this? That is exactly the point that people are making, about the benefits of it, as well as the costs. Can I just bring Peter and Andy in on Peter's question and then others, if we have time? Peter Quinn.

Peter Quinn: Thanks for giving me the floor—simply to say that that is the prize. That is a huge prize, isn't it?

Andy Lewis: I would say we do need to act quickly. Obviously, Norway is ahead of us. Norway is the default nation to go to—

Q247 Peter Kyle: In what way? How far ahead? In what way?

Andy Lewis: Well, they have delivered the project, basically. They have the Sleipner project that is operating. They have Equinor. They are heavily involved with it. We need to be replicating that, so our companies can export the knowledge. They have delivered a project. We have not, yet. Once we have done that, then we can start to export.

Steve Murphy: Just to correct that. Sleipner is very good. It is simply gas separation. It has been happening for a quarter of a century. They have the fertiliser plant. They have CO₂, as we have been talking about. Sleipner is different to any other. It can capture from steel, capture from power, or other industries. It is a gas separation process.



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Jonathan Briggs: From an oil and gas perspective, the Norwegians are very active. They have their projects. They have done projects elsewhere. Stepping back, considering where we are, I would say the Norwegians do not have the assets that we do here, and the demand, the scalability. They try to do things to get over that. My personal view here is that if we lose this opportunity—the first mover advantage—shame on us.

Q248 **Peter Kyle:** Lord Haskins, are we a good destination for international investment for these kinds of projects? Is the environment a good one?

Lord Haskins: Yes, I think so. We have done some talking to potential investors on the onshore wind side and they are very positive about it. They like the regulatory regime, very much so. Slightly anxious about the politics, but, generally speaking, I do not think we have had much difficulty in encouraging them. They are very keen to come.

Q249 **Peter Kyle:** Finally from me, I am sitting round a table of men. Do women not get interested in your business?

Steve Murphy: We are 50/50.

Q250 **Peter Kyle:** You are 50/50?

Steve Murphy: Yes.

Q251 **Chair:** When we asked for witnesses to come to this session, all of your organisations put yourselves forward. So, if your organisations are 50/50 women, as you suggest, then why were no women made available? We have 10 witnesses around the table today and you are all white men. It is not unique to carbon capture and storage. This is the same in many of the evidence sessions we hold. But saying, "We are 50/50 women, no problem, move on", we cannot really move on, can we, when we look around this table?

We do have a lot to get through today, but just coming back with answers such as, "There are two of us in our organisation and one of us is a woman"—well, it is a shame that she is not giving evidence today and, Steve Murphy, it is a shame that a woman is not giving evidence from Blue Dot Energy. You have all given very good evidence today, but I do think that your industry would look a lot better to policymakers, and to attract the high-skilled people in the future, if you showed that your industries are inclusive. I have met many of you in other settings, and have come to your businesses and, if it is 50/50 women, well they were obviously all on holiday on the days I visited.

Mark Lewis: My woman partner is on maternity leave.

Chair: Okay. Well, I am glad you all have excuses for why the women are not here today and we have heard some of them today. If I were you, I probably would not give us any other reasons, but just reflect on how this looks when this transcript is written up and when you go and see Ministers, including Claire Perry, how she will feel about who your industries attract. "She is on maternity leave", the 50/50 women, there is



no problem, move on—what is this woman and Peter Kyle going on about—I do not think that is the right response to the challenge that I have just put to you. We will now move on to Anna Turley’s questions.

Q252 Anna Turley: I want to move backwards to some issues that were raised under Stephen’s questions around funding and the way the Government are supporting these projects to be developed in terms of clusters and the geographical spread, and so on.

We have heard a lot today about how competition is not the word for it, it does not support collaboration, does not support the sharing of intelligence, research and development, and so on. What would be a better means for Government to fund the CCS industry clusters? How should they be allocating the money, if you were designing this process?

Jon Gibbins: Going back to the question, when you say “allocating the money”, by what mechanism is this money being allocated? The different projects that we are starting up with, I think need money coming in different forms. If you are doing an electricity project, I think you can have a CfD. I think that could be extended to full chain. If you are doing a gas project, you want an RAB. If you are doing some of the other industrial projects, you probably need capital, because you cannot charge the industry more than the carbon price.

First of all, give it by the correct method. Whatever method you give will be determined by the project. Then, we are looking at one-offs at the moment in the sense that all the projects are different. We would hope to get repeats in some senses of those projects, but there are not an unlimited number of different opportunities.

What I would say is that, rather than asking for specific answers, you ask for general principles, and I mentioned them earlier. The Government need to make an assessment of what CCS across the whole of the country looks like because, if you do not do that, you cannot assess how individual projects would feed into the bigger picture.

You also need, when you give money, to be prepared to give some money for helping that project to configure itself in a way that is not just very narrowly set out, saying, “We just want to deliver this particular project. We don’t care about anything else”, so that they are incentivised to configure the project, as far as possible, to help other projects. They would not naturally do that, but they are after government funding and the Government want that to happen so I think that is very important.

You should also ask them again to think how they can help the larger picture in terms of innovation, which will be different for all the different projects, but all of them, I think, given that we are just starting, have some measure of innovations, and I think that is quite important.

While the Government is expected to fund this, in advance of it becoming a normal commercial activity, and we do that to get a lead for the country, to make it cheaper eventually, then I think you need to put in, in



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the incentives—in whatever form they come; they will be in different forms and people should be pragmatic about that—if you want these other dimensions, to get the benefits, you need to reward them. Does that answer your question?

Anna Turley: Yes, that does. Thank you.

Jon Gibbins: Can I say one other thing, relevant to the last issue? Exporting the technology and getting value for export, yes, that is valuable. I do not think, though, that is as valuable as supporting the overall industrial base in this country with low-carbon energy, as it happens. And in terms of exporting, you have to reflect why we are spending this money on cutting CO₂ emissions and it is not to meet our targets; it is to avoid dangerous climate change. The UK can meet its targets and if we do not avoid dangerous climate change, which requires political action, the money will have been wasted and we will have a lot more problems.

What you have to think is: if the UK spent—pick a number—£5 billion on CCS, the world would sit up and take notice and you would have made a very material contribution to the progress on climate change because nobody else is doing CCUS. The UK is uniquely placed to do CCUS. We have the carbon, we have the storage, and we have a good Government, which actually think about these things in the Committee on Climate Change. If the UK spent £5 billion on nuclear, the world would barely notice. If the UK spent £5 billion on renewables, because they already there, the world would barely notice.

So, in terms of bangs for bucks, in achieving the real result, which would matter to our children, grandchildren and further on, CCUS, just because of its rarity, would have a really big effect. I know that sounds idealistic, but ultimately if you say, “We have wonderful exports, but we have loads of climate change”, what would we be saying?

Q253 **Anna Turley:** That is a very powerful argument. Thank you. That helps us in this project.

I will ask others, just going back to the previous point; what you say is very powerful but it is very difficult when the Government are setting criteria to enable comparators and you have different projects with different industrial facilities, and so on, and then, of course, you have projects with different aims, some are storing, some are using, some are producing clean hydrogen. What are the sorts of criteria that will enable Government to set this competition? If you are helping them, given that we are where we are, and the Government have said they are going to have a competition for this project, how would you help them set fair criteria for that?

Pete Whitton: Whatever we do, we must not go to where we did before on that sort of competition. We are building infrastructure, essentially. This is an infrastructure project. If I was going to build a road, I would be making a proposition for a road. I am not going to be in competition



directly against somebody building a road somewhere else. There is a need for this sort of infrastructure at least at the five cluster locations. The benefits of those are a substantial GVA at each of them. Step one is to say, "What GVA could be achieved by when?" and, "What is the business case for doing it?" The initial thing is to make sure that there is enough funding and then each of those regions can produce that business case.

There needs to be an assumption that, other things being equal on affordability—because you quite rightly cap the amount of money—you would go ahead with as many as you can, all if possible, but as many as you can. The criteria that you would use then are the same criteria, in a way, that you would use to put in any other infrastructure. Is it done as cheaply as possible? Is it able to be provided when it is needed, that is in the early 2020s in this case? Also, in this case, can it be expanded? I might start small and make it larger and, in that way, I will get along.

The criteria start from the value for money and the need and then work backwards, rather than where they did before, which was very much a competition. The very first question was, "Are you collaborating?" and the answer is as soon as it was said, "There is only one project", the natural collaboration started to tighten up. It became less a competition.

Jonathan Briggs: Adding to that, and again to the point I made earlier, you want to figure out what those criteria are, and they are pretty broad; there is a mix of storage assets, the capability that you are going to deploy in the scheme, and you have the financing, you have the investors behind it, who is ready to go? Absolutely, we all collaborate, we are all in the same place, we are all members of the same associations; we want to see this done, as an industry, but the criteria have to be trying to figure out which ones of the projects are ready to go and in what order.

Anna Turley: There is a sequence.

Jonathan Briggs: As is always the case, there are different stages of technology readiness. You can see collaborations within industry that are saying, "We have done a lot of this work already. We would like to propose—" There are a lot of leaders in certain direction but are different stages of readiness that we, as an industry, know ourselves, anyway. That is what I think the criteria really need to drive.

Andy Koss: I would agree. Scale is very important and commercial viability. There is no point in investing in something that ultimately is not going to get to the scale and is not going to be there at scale in future.

There are two other points around earlier-stage funding. It is really important that the private sector co-fund this as well. It is not right that people are asking the Government just to invest. I think there needs to be co-investment because I think that drives efficiency and, again, it drives that commercial viability. Then innovation funding, I think it is really important now that we look at projects that are already doing



something and are ready to be deployed, rather than all the desk-based research. Even round the table, there are projects ready to go. Let's start investing in people who have already made those investments and where we have more chance of success, rather than in desk-based research.

Jon Gibbins: I guess you should not assume that you are planning something and it will automatically happen. You might want a broader approach so there is some backup if things get held up for whatever reason. Otherwise, if we plan to do one, it could go two ways. Whereas if we plan to do a few, which we are going to need anyway, then we will probably get one and if we get more it does not matter. If we get zero again, it really will not be a very good result for the country or the world.

Pete Whitton: What I am hearing is what I usually ask, which is: will it work? Can they deliver it? Can it be exploited? Can it be expanded? That is how I always look at these things. I do a lot in gasification and I am hearing a lot here that is equivalent to that.

There is something around the UK's engineering base that needs to be thought of. We have fantastic engineering skills. But when we are looking at these new technologies, the way these engineers work is they bring in contractors to work and there is a lack of engineering historical knowledge within companies. You bring in an engineer: today it is a female engineer, number one, and tomorrow it is a male engineer, number two. There is no historical link from one project to the next, so there is something around corporate memory in engineering that is a little bit lacking, making it difficult to deliver gasification projects—

Q254 **Chair:** Some of you—many of you—have spoken about the future quite evangelically, about the role of carbon capture and storage planning and it is really good to see that, and the vision you have.

If the Government do go ahead with, say, two projects and three of you will not get the Government money in the first place, would you see that as a big setback or would you think, "Well, at least they are getting started, and if those are successful we can learn from them; if they prove to be successful and the benefits are what you expect them to be, it will come to us?" How important is this competition and how challenging will it be if the project that you have put so much into might not happen?

Jonathan Briggs: A very quick rider to what you said. I think there is a much more tangible benefit than learning from it. Within a lot of the projects, particularly if you have an east and a west, if that project goes ahead, I will then know where I can put my CO₂. It is a lot more tangible than giving an example. It is fantastic, in fact; they have done all the hard work and now all I have to do is to build a pipeline and that is the problem solved.

If you can do that as well, I think that is a question to ask them. If you start off with one east coast project and one west coast project, you



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could do precisely that. The next one down the line could say, "That's all I have to do, to get to that point".

Q255 **Chair:** That is for you, Jon. The problem is everyone has a stake in this. That may good for you, Jonathan, but is that how you all see it and how the oil and gas sector sees it? That there is a project, if Humber or Teesside or Scotland were chosen, you would just move a pipe, and the CO₂ from Teesside could go to Andy in the Humber, or vice versa? Are you relaxed about that?

Jonathan Briggs: I absolutely agree that, once you have started somewhere, you have the ability and that is where your cost curve is going to be developed, basically. You are allowing others to invest basically off the back of it. On the basis that you have an industry started and deployed and all these questions around: how much does it cost? How do we do this? How do we build on it? Is it going to be material and by when? You start to ask these questions.

From an oil industry perspective, back to one of the earlier questions in this discussion, which was: how important is it to your industry? I did not get the opportunity to say that it is obviously very important. The oil and gas industry will play a part in it, no matter. So where it occurs, and as long as it is basically done on the right basis of starting off at scale and making sure that you are able to basically deploy in the background, you are already off to a good start.

Andy Koss: We made the point about the financial investment community. This is really important. We would all like to be in that first round of projects but the key is that if the Government deliver on their commitments, what the financial community will see is that the UK is committed to CCUS and I think the investment flows.

If we have what we had before, which is another competition or another focus on CCS, which then falls away—I think it is inevitable; I think we need CCS and it is inevitable that it will come back on the agenda—it makes it harder and harder each time, to bring investors in, get the focus, get companies to focus on that. Each time it just falls away.

Q256 **Chair:** The Government doing something substantial is likely to leverage in more private sector money and, also, the issue that others were making earlier, that you have assets that are available now in which to store the carbon and the longer you leave it the cost will go up. It is not that costs will fall over time; the costs are going to rise unless we take advantage of the assets we have in the UK.

Andy Koss: Absolutely. Capital can be deployed anywhere in the world. The oil and gas majors, they are looking now and they are interested in the UK, but if there isn't the support they will go somewhere else.

Jonathan Briggs: That is just what I was going to add, very briefly, exactly that point. Also, it goes without saying, nobody—whether it is the



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oil and gas industry or anybody else—is going to do it by themselves. That is one very clear lesson from the past.

Q257 **Chair:** Geraint Evans, did you want to add something?

Dr Evans: The fourth universal benefit, lower cost of finance and lower risk.

Chair: The last two points, Steve Murphy and then Peter Quinn.

Steve Murphy: Just to make sure we do not lose the point, capital funding is of course welcome and it ought to be match funded. In order to get the level of match funding that is required, there is going to need to be a revenue model. So funding, ISCF [Industry Strategy Challenge Fund]2025, or whatever, in and of itself, is only part of the story. That helps to reduce the cost of capital and therefore the cost of the project. The revenue model, or business model, is absent at the moment, therefore no market, therefore nothing is happening.

Peter Quinn: To add to that, the consensus response to that question is two or three projects receiving some substantial amount of support would be preferable—sorry to use the word “scale”; it is such an ambiguous or unclear term—because it does give some scale and impetus and enables some stuff(? 1:32:13).

One thing I said earlier that I think is important: there are 101 different permutations around different CCUS technologies and some public support will be needed to investigate, to deploy, and commercialise, some of those different technologies. Therefore, we need to give some thought to the fact that we cannot put that entire potential public fund on just two big exemplar projects. There has to be some baseline funding available.

There are other research and development funding mechanisms that exist but there does need to be some support, so it is also about match funding. Some industries cannot match. They have no cash at all to put in millions of pounds, so there is a real cash barrier there.

In the context of the steel industry—and I suppose I speak for manufacturing industry generally—there are lots and lots of streams of work currently going on, not least with some of the partners around the table. We need to investigate certain technologies and techniques that are novel. We do want to do that and we already invest in what we can and we are drawing down funds from different sources, for example European funding or industry funding, but we do rely upon that in order to continue.

Dr Evans: You touched on social science, and I do some social science research at Cardiff University with PhD students and it is quite important to understand about public perception, and that is what they do; they think about how people make their value judgments and learn what makes good or bad in terms of technology. This could be something



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that—coming back to the research angle—perhaps should be looked at. I am quite interested to link engineering to social science because you need the social licence to operate.

Chair: Thank you very much, all of you, for coming to give evidence today and also thank you to the people who have come to watch this session today. For us, it has shown the importance of getting out of Westminster and hearing from people who are making the business decisions and doing the research on the ground.

I want to thank, as well, Wilson Business and Science Park for hosting us here today. We really appreciate this opportunity to be with you here in Teesside.

This is the final evidence session that we are taking on CCUS and we will be publishing a report in the coming weeks. If you have anything else you want to add in to that inquiry, we will take that on board as well. This has been a really important inquiry for us. It is certainly one of the industries of the future. We look forward to seeing in the months and years to come, Government decisions, and then also putting it into practice at scale across the UK. Thank you very much for your time today.