

Energy Security and Net Zero Committee

Oral evidence: [Keeping the power on: our future energy technology mix](#), HC 116

Wednesday 6 March 2024

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Members present: Mark Pawsey (in the Chair); Vicky Ford; Lloyd Russell-Moyle; Derek Thomas.

In the absence of the Chair, Mark Pawsey was called to the Chair.

Questions 437 - 508

Witnesses

I: Professor Keith Bell, Member, Climate Change Committee; Craig Dyke, Director of System Operations, Electricity System Operator.

II: Tim Ambler, Senior Fellow, Adam Smith Institute; Professor Robert Gross, Director, UK Energy Research Centre; Dr Doug Parr, Chief Scientist and Policy Director, Greenpeace UK; Professor Jim Watson, Director of the Institute for Sustainable Resources, University College London.

Written evidence from witnesses:

- [Electricity System Operator](#)
- [Adam Smith Institute](#)
- [UK Energy Research Centre](#)
- [Greenpeace UK](#)
- [Institute for Sustainable Resources, University College London](#)

Examination of witnesses

Witnesses: Professor Keith Bell and Craig Dyke.

Q437 **Chair:** Good morning, and welcome to the Energy Security and Net Zero Committee. We are conducting a session on the energy sources that will take us into the future. We have two witnesses for our first panel. Would each of you introduce yourselves for the record, please?

Professor Bell: Good morning. I am Keith Bell, from the University of Strathclyde. I am a member of the Climate Change Committee, and I am here this morning representing the Committee.

Craig Dyke: I am Craig Dyke, director of system operations at the Electricity System Operator, set to become the Future System Operator in July.

Q438 **Chair:** Thank you very much for being here, gentlemen. My first question is to Professor Bell. A whole series of new technologies are being spoken about, both in this Committee and more broadly, to do with how we sustain our electrical supply given the increased demands that arise from transport, from home heating and from the decarbonisation of our industrial sector. How do the various technologies stack up, and are enough options available to us at the moment?

Professor Bell: I believe we have enough options. The heavy lifting will be done by variable renewables dependent on the weather, so solar and wind, both onshore wind and offshore wind in particular. The reason is that on a simple levelised cost of energy basis, these are the cheapest new forms of energy. If you are building new plants to get new capacity, those are the cheapest ways of doing it.

However, by their very nature, renewables are variable so they need to be complemented by something else, and of course, that something else also needs to be low-carbon. There are, as you suggest, a number of options. As we know, a nuclear power station is under construction. If we are going to use gas, we have to capture the CO₂ emissions. If we are going to continue to use bioenergy on any scale—and there is a limit to what that scale might be because of competing uses for land—then really we should be capturing the CO₂ from the use of biomass as well.

Then there is the potential for us to import from neighbouring countries and to export surpluses. Because of the variability of wind and solar, there will be times, as we scale up capacity, when availability from wind and solar will exceed demand. We really should have some way of making use of that available energy without having to curtail it. We could export it to our neighbours, or we could use it to manufacture hydrogen using electrolysis. Hydrogen has the potential to become a really important means of moving energy through time so that it can be a resource when it is not windy or sunny.

Q439 **Chair:** You spoke about things that we could do; which ones should we



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be doing? Is there a clear enough idea from your organisation, and from Government, as to which road we should be going down?

Professor Bell: There is a need for clarity. I would not say that the work we published in March last year gives a prescription. That was not what we were trying to do; we were trying to show that a fully decarbonised power system by 2035 is entirely feasible, and based on the relative cost of the different options that were available to us at the time, we were able to suggest what the mix might be.

The crucial thing is to make full use of wind and solar, recognising that some would be curtailed. What is the economic balance of curtailment? A lot of that relates to the network, which I am sure we will come on to, but there is also a need for what we might call schedulable, or dispatchable, sources of electrical energy: something that you can be confident will produce energy at a certain time when it is not windy or sunny.

There are competing technologies for that, as I mentioned already—something with carbon capture and storage, or something that uses low-carbon hydrogen. We also need enough that is flexible to fill in the gaps, because demand goes up and down and wind and solar availability goes up and down. The classes of types of resource are very clear, but there are some options within each class that will really depend on the economics, the market and how they get delivered.

Q440 **Chair:** Mr Dyke, Professor Bell has told us about the sources of generation. Do you think we have a clear enough idea of which ones we are going to adopt and what the way forward is going to be?

Craig Dyke: If you look at our future energy scenario, it talks about new nuclear power stations, it talks about gas-fired power stations with carbon capture, it talks about gas turbines fired by hydrogen, and it talks about long-duration energy storage as well. You need the whole mix in order to make it secure in the future: you need renewables in order to drive down carbon, but you also need clean, non-weather-dependent technologies to make up for the days when the sun is not shining and the wind is not blowing. All these things need to come together, and for that to happen, you need several different factors to work: you need the right markets and the right market development to attract investment and the right technologies; you need the right level of networks that meet the needs to get the power from source to where it is required while also being cognisant of community and local needs; and you need the right resources.

It is not just about the technology. Remember, this is a global market and the rest of the world is competing for these technologies. We need to think about the whole supply chain.

Q441 **Chair:** You both referred to nuclear; how important is nuclear going to be in the mix? We understand the need for baseload, but how much should we have?



Professor Bell: I tend to avoid talking about baseload. The idea of baseload was useful and important in the past because the demand for electricity never went below a certain level: you could depend on some source of electricity operating 24/7—just put it on and leave it there. We should now be thinking about the residual demand; in other words, the difference at any moment in time between what the demand is and what is available from wind and solar. That number will vary a lot as we get more wind and solar; sometimes it will be negative meaning we have a surplus. The idea that something is just on all the time only works if you have more uses for that energy at the moment it is operating.

Q442 **Chair:** Mr Dyke, could we have your view? I was hoping that Professor Bell might give us a percentage—

Professor Bell: Which I avoided.

Chair: He avoided doing that. Are you able to do so?

Craig Dyke: No, because we are quite technology agnostic. We understand the need for flexibility in the market, we understand that the market needs to provide low-carbon generation, but with regard to putting a number on any of the technologies, that is not something we do. Ultimately, it is for the markets to determine the right answer, and therefore to ensure that markets are designed so they are incentivised to bring the right technologies forward.

From my perspective as a system operator, I would like to see a blend of technologies because it allows you to cover for all eventualities on the network. That is certainly what I would prefer.

Q443 **Chair:** How much nuclear does it require to have the right blend to ensure that we are getting electricity out at the right price—or the price that consumers are comfortable with—while still maintaining the security of supply?

Craig Dyke: It is less about the number and more about, as Keith says, the flexibility. You need flexibility from the generation source, and what that is made up from is the key issue.

We are moving away from a world where supply was traditionally matched to demand, where you could pretty much take today's demand and know what tomorrow's and the next day's would be. With the various technologies regarding embedded wind and embedded solar, demand changes more now than it ever did in the past; you also have changes in consumer behaviour such as charging electric vehicles, so now you are trying to balance both sides of the equation, whereas, historically, you were only looking to balance on one side.

For us, it is all about flexibility in the generation mix as opposed to what is the absolute number. Looking forward through our future energy scenarios—if I remember rightly—in the mid to late 2030s, you are probably going to require 160 or 180 gigawatts of available capacity in



the market in order to meet the need. That will be made up of both renewable generation and flexible generation.

- Q444 **Chair:** We have heard that renewables are an important component because they meet zero carbon targets and their price has fallen substantially, but is there a danger that if we worry too much about price, we are not going to have enough resilience in the system? We could go entirely renewable through wind or solar, but we would not be confident of a maintained supply, so where does that balance occur?

Craig Dyke: There are three key elements that we think about. The future electricity system must be secure: it must be able to provide supply on those days when the wind is not blowing and the sun is not shining. On those days, you need that clean, non-weather-related technology in order to make the supply secure. It must be operable: we, as a system operator, must be able to take the energy from where it is produced to where it is needed in the right way. Finally, it has to be affordable and fair. The two elements of market design and the network strategy have to join together in order to produce the cheapest solution for consumers.

- Q445 **Chair:** We have not defined what proportion should be generated by different sources; does that mean there is a lack of certainty? We cannot say to nuclear, "We are going to need this," or to biomass, "We are going to need that," or to wind and solar, "We are going to need something else." Does it mean that the supply chains are not able to meet the demand because we have not yet told them what it is?

Professor Bell: That is a fair point. There is a lot of talk now about a strategic energy plan, and, moreover, a strategic spatial energy plan that takes account of locations and puts some pivots in place around which the market can move in order to deliver cost effectively. Such a plan has to take account of risk and it must deliver a sufficiently resilient system, so you are quite right to raise that issue.

There will be things that are already being invested in that we can get going with right now. Success in the next auction round for CfDs is going to be really important to show the pathway for variable renewables in particular. We also need to keep some options open in terms of the rest of the mix, as Craig was describing, but at some point, as you imply, we do need to narrow down so that the market has the confidence to deliver. Part of that plan must also take account of the risk that the market will not deliver, that certain technologies might be overpriced, over cost or delayed, while still delivering a sufficiently resilient supply that takes account of the variability of weather and what is happening in other countries.

- Q446 **Chair:** So we need to maintain some flexibility in our approach because we cannot be that confident about the future?

Professor Bell: We must be clear enough about what needs to be developed that the market gets on and delivers it, because we do not



have very long. The rest of the economy, in terms of the decarbonisation pathways, depends on the electricity sector being decarbonised. Delays or failures to decarbonise there will have an impact elsewhere, such as our ability to comply with the sixth carbon budget and the 2030 nationally determined contribution. We have to get the electricity system right. We do not have long, so we have to get on with what we can now and recognise what else we need, such as the use of hydrogen to provide resilience, which depends on the ability not just to make low-carbon hydrogen at scale, but also to store it. What are the commercial incentives for anybody to come in and deliver all those facilities and the associated infrastructure?

We really need clarity on a plan that takes account of risk in the right way, but also clarity on the commercial mechanisms to deliver these key components and get the basic facilities underway now.

Chair: I am sure we will come on to that. Derek Thomas?

Q447 **Derek Thomas:** Thank you. Professor Bell, in terms of speeding up the deployment of low-carbon energy technologies, what more could the Government do to support the rollout? I am talking about not necessarily financial intervention, but what environment the Government needs to create to support accelerating deployment.

Professor Bell: One of the key things is establishing a market for the product or service. You just mentioned hydrogen; low-carbon hydrogen has to be defined in the right way to encourage investment in producing it, storing it, and using it, but that also has to be done in a way that does not unduly tilt the balance too far towards hydrogen. When you look at the cost of the technologies and what is available to be used, a lot of the decarbonisation of manufacturing or industrial processes should actually be done through electrification. From what I understand about the way things are incentivised right now, there are some parties that are looking towards using low-carbon hydrogen because of the significant subsidy that is available; it is not a level playing field.

So while these kinds of commercial mechanisms do need to be put place, they need to be put in place having in mind all the energy vectors and the right mix between them, not on a vector by vector isolated basis.

Q448 **Derek Thomas:** Can I pick up on the hydrogen issue? There is a conversation about whether it should be used for heating homes, for transport or for storage. Where do you sit on that? Do you think the time is right to invest even more in the hydrogen transport and storage infrastructure, and is that where the pressure is really needed?

Professor Bell: Our work in the CCC reveals that there is a need for hydrogen. The question, as you imply, which you hear from all sorts of different parties, is how much is needed?

I am sceptical about the extent to which hydrogen really is the right answer in terms of heating in homes. If you are producing electricity, just



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use it as electricity and make use of the heat pumps. There are energy conversion disbenefits from making hydrogen and then storing it and burning it and so forth; there is a whole specific infrastructure that would need to be built around it. But, yes, our analysis suggests that there is a significant quantity of low-carbon hydrogen that we will need for the electricity sector at the very least, for all the reasons we were just talking about, and very likely for parts of the transport sector such as aviation, shipping, and potentially heavy goods vehicles, where batteries are too heavy.

There is a whole other set of challenges about getting the right infrastructure to get those low-carbon fuels in place. At this stage, it seems likely it will be based on hydrogen.

Q449 **Derek Thomas:** So you are talking about the right technology in the right place?

Professor Bell: Yes.

Q450 **Derek Thomas:** Are the conditions now in place for large-scale, long-duration energy storage to be built? Is everything ripe for that now, or is there more the Government need to do?

Professor Bell: I do not think the conditions are ripe for that now, and I welcome the Government consultation on this issue. I think they produced the consultation paper just before Christmas, which starts to recognise the need for large-scale, long-duration energy storage. Of course, there is a whole debate we should have about how long is long in terms of the duration. At the minimum end, six hours is okay, but we need to go a lot longer than that. The key point is that we need that capacity on the scale of terawatt-hours—you can look at different models and discuss how many terawatt-hours—but regarding the duration, how long you might be leaving the energy in storage, we are talking weeks, months, potentially years, to deal with the rare dunkelflaute type of circumstances, and the commercial model for that is quite difficult.

If you are making money as a developer of an energy store by purchasing the energy when it is really cheap and selling it back into the market when the market price is high, you of course make more money the more times you cycle the energy through the store. But if you are just going to have a store and leave the energy there for years, you do not have the opportunity to make money and you have a very high capital cost for the store. We do need that large scale storage to be developed and get under way very soon for 2030, 2035, that sort of timeframe, and we need the right commercial mechanism to encourage its construction and operation.

Q451 **Derek Thomas:** Moving on from storage to the demand side, are the conditions now in place for demand side response to become a major part of the energy system? It is a big conundrum.

Professor Bell: I think Craig already has some experience of that.



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Craig Dyke: For decades we have used demand-side response to manage the system. It is very much driven by industrial and commercial load, and ultimately a lot of the demand provision has been netting off demand and running backup generation. If you go back to the winter of 2022-23, when things were really tight because of Russia's illegal invasion of Ukraine, we launched the Demand Flexibility Service, working really closely with big and small suppliers to access demand at a consumer level, right down to domestic house level for those with smart meters. In the space of a year, we have seen significant growth in that market from a couple of hundred megawatts to, this year, 500 or 600 megawatts. We are also seeing really big consumer engagement as well, but the real win is the way that suppliers are engaged in developing their own products to grab that demand into their supply chain, in order to incentivise cheaper electricity both for themselves and for the consumer.

The question for us now is how do we turn what was intended as a security of supply type service into something that is more enduring, so people can engage more frequently, whether it be electric vehicles or heat pumps? That is something that is happening today, and it is actually a first in the world step.

Q452 **Derek Thomas:** What drove that quite stark acceleration? Was it the spike in the energy price, and are we unlikely to see that continued investment in the domestic element?

Craig Dyke: It was less about the price and more about the preceding winter. We had to ensure that we were not overly reliant on gas, knowing what could happen if the pipes were cut off from Russia.

What happened because of that urgency was that we, together with the Government, Ofgem and industry, really accelerated that development of consumer-level demand. Normally, it would take six to 12 months to develop or incrementally change a service, but with industry, we developed it all in the space of three to four months and then rolled it out and saw the returns pretty quickly. So the answer to the question of whether supply and demand flexibility works is yes, and that has been absolutely proven.

The other factor is that when we, the Government, the regulator, and industry work together with a really sharp focus, things can happen quite quickly. That is important as well.

Q453 **Derek Thomas:** We have seen many examples of that, but is there a danger that we might drop back when things are more stable and safe, and not continue that level of drive? Or do you think there is a quick win that is sustainable now?

Craig Dyke: Part of what we are looking at now is how we turn what is effectively an out-of-market solution that we use and access in order to maintain security of supply, into an enduring solution. We are doing some work with industry, Ofgem and Government to work out how we turn a



security of supply-only product into a commercial product that allows actors to come in and participate as and when they want, as opposed to just a system that operators need. It is about giving the consumer choice so that they can participate when they want to participate as much as when the system operator needs them.

Professor Bell: I wonder if I could come in on the demand side issue? Flexible demand has always been the holy grail for energy system economists. We finally have the pieces starting to come together—some of which Craig has been talking about—but I think, crucially, we need the ability to measure the use of energy in different periods of time, so that there can be a response and a reward for the different time of use signals. One of the reasons why that is so important is, of course, the variability of demand relative to the availability of the energy. We want electricity to be used when it is windy and when it is sunny; we want electricity use to flex and move through time according to that, so we have to measure on a half-hourly basis whether people are using it in response to the fact that it is really cheap because it is windy and not using it at another time.

Half-hourly metering across the entire market, not just industrial and commercial but also residential, is a really important factor, and it must also be easy and worthwhile for the consumer. Electric vehicles, just as an example, give an enormous amount of flexibility if they are plugged in and do not impact adversely on the consumer at all.

Derek Thomas: That is brilliant. Thanks.

Q454 **Lloyd Russell-Moyle:** On the point about flexibility, surely it has to affect the consumer to some extent, which is why there is a price differential? Consumers choose to get the bonus and make their life more awkward by it or they do not; otherwise there would be no price differential. I put energy on when I want it, not when it is needed.

Professor Bell: The key is that it should not be as awkward as all that. It is true that if you want to use electricity to do your cooking, or you have an industrial process that has to run at a certain time—

Q455 **Lloyd Russell-Moyle:** Such as a heat pump that you want when you want it, not when the electricity goes?

Professor Bell: Exactly. If it is cold outside, of course you want to put the heating on. I am sceptical of the extent to which we can get a lot of flexibility. I am not sure what proportion of the total demand will be flexible. I know you are going to speak to Rob Gross later on, and he is sceptical about this as well, but there is still significant potential. If you have well-insulated homes, you can switch off the heat pump for an hour or two, and it does not have a big impact. Certainly, with electric vehicles, the average car today—you can hide a lot with averages—spends 95% of its time parked. You very rarely need to have a complete recharge of the battery as it is not always completely depleted. If it is



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parked in a place that has access to a charge point and is plugged in, there is an enormous amount of flexibility in when that charging takes place. The trick then is you have software provided by the energy supplier that sorts it out for you and makes it easy to take advantage of when the energy is cheapest.

Lloyd Russell-Moyle: It is automation.

Professor Bell: Yes, automation. It is still under the control of the user, so they can express preferences and limits and so on. It does not take over and demand that you switch off the telly when the Gooners are in the Champions League final—there have to be some limits—but the idea is to make things as easy as possible and then it does not have to be awkward. Of course, there are limits as to who can take advantage of it at what time, so this has to be done in an equitable way as well, but there are definitely useful opportunities.

Q456 **Lloyd Russell-Moyle:** Are there maybe opportunities to collectivise rather than individualise this? At the moment, if you are in a nice big house, and you can afford battery technology, you can live your life without any inconvenience and get the benefit. But if you are in a small flat with no space and no roof and you are cash poor, is there opportunity to collectivise in small groups or communities, so that people can generally benefit from some of these things?

Professor Bell: Absolutely, but you touch on something that is fundamental there: the quality of the housing stock, which makes a big difference to the affordability of energy and the quality of the heating system. The building fabric and so on are parts of the infrastructure that need to be right. In theory, the market delivers collectivisation through a product offered by an energy supplier. That is basically what the supplier does by being big enough to operate in the wholesale market on behalf of their customers. A successful supplier will offer an attractive and easy-to-use product, do the collectivisation and build up a critical mass of energy users so it can get a good price in the wholesale market and pass it back to customers.

Q457 **Lloyd Russell-Moyle:** But most energy providers provide one flat rate at the moment so there is no doability there. It is all a bit of a mess.

Professor Bell: Yes, you are right. The whole retail market is a point of discussion, and it is not in a good state. The things that Craig talked about earlier have taken too long to develop.

Craig Dyke: There are suppliers out there that are innovative in this space and have leading-edge tariffs. Personally—I will not name the supplier—I have a tariff where it costs me less than 3p a mile to charge my car if I charge between 11.30 pm and 5.30 am. There are other schemes, such as the ability to get paid if you are willing to discharge your car back into the system, so there are novelty tariffs out there which are working.



Q458 Lloyd Russell-Moyle: The majority of people will never have access to them: they will park their car on the street and pay a huge premium for a street charger because they do not have a garage. So rich people will benefit from this.

Craig Dyke: I agree, and this is the point: no one should be left behind. These tariffs need to work for all, not just for those who have the money.

Q459 Lloyd Russell-Moyle: Craig, what influence do you expect the Strategic Spatial Energy Plan to have on future investments in the grid and storage areas?

Craig Dyke: It should set out a completely holistic plan at a spatial level to determine the best sites for generation and demand and ensure they know where to connect, but you are also minimising the network investment. It should not just be about electricity but it should look across the whole energy system at electricity, gas, hydrogen, carbon capture and storage to give an optimised plan that delivers the best and cheapest route to net zero for consumers as well.

Q460 Lloyd Russell-Moyle: It all sounds nice, but who is responsible? Who gets it when it is not delivered, and who gets rewarded when it is? In your evidence, you talked about strategic accountability to assigned bodies. Do you have any more meat on the bones of who those are and how that accountability is held? Is that something you could provide us?

Craig Dyke: In the Winsor report, it is recommended that the Future System Operator should be the party that picks up the Strategic Spatial Energy Plan. That decision is yet to be made and lies with Government. We are still waiting, but once that decision is made, whichever party it is, we will understand the scope of what it will look like but also the timescales needed in order to deliver it. That should also answer your question as to which are the right bodies and parties to deliver the plan.

Q461 Lloyd Russell-Moyle: The Future System Operator should hold the main responsibility, which should be given to other bodies underneath it to deliver?

Professor Bell: That is how it looks. You are absolutely right to raise the question. There is a lot resting on the delivery of this plan, and I am quite encouraged that there is a bit of momentum behind it, if it is done well.

Q462 Lloyd Russell-Moyle: Is it moving quickly enough?

Professor Bell: That is a very good question. It is very difficult to do. As we just said, Government seem to be taking quite a while to clarify exactly what the NESO will be doing, how that relates to Government's own role and that of Ofgem, and then how all this will be delivered. It is all very well to come up with a plan, but how will it be implemented? How will the market deliver?

Q463 Lloyd Russell-Moyle: When would you like this plan to be delivered by?



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Professor Bell: For the plan to be published? What has been suggested by your colleagues? Maybe by—

Craig Dyke: Ultimately, the timescale will be determined by when Government want it. The Government need to advise who is going to do—

Lloyd Russell-Moyle: I understand that when it will be delivered is down to Government. What I mean is—

Professor Bell: When would we like it to be delivered?

Lloyd Russell-Moyle: When do you think it needs to be delivered?

Professor Bell: As soon as possible.

Q464 **Lloyd Russell-Moyle:** Is there a realistic time that it should be delivered by?

Professor Bell: A first cut should be possible in the next six to 12 months. It probably would not be able to get into a lot of the spatial detail that we would like, but I hope, as a first iteration, it would give some clarity about the nature of it.

Q465 **Lloyd Russell-Moyle:** We need to push Government and say the first draft needs to be here within six to 12 months?

Professor Bell: Yes.

Q466 **Chair:** What is the downside if it is not available within a reasonable period of time? What would the consequences be for the decarbonisation plans that we have set?

Professor Bell: That is a good question. One of the issues is about planning and consenting. When someone does not want something to be built in their neighbourhood, the first thing they will say is, "Well, why do you need it?" We hear this up in the north of Scotland, for example, where the locals say, "Well, okay, it's to accommodate a wind farm, I get that, but why does the wind farm have to be here, and why couldn't it be somewhere else?" I believe this is what was in Nick Winser's mind when he published his report last year. If there is a clear, credible, concise, holistic idea of how, all things considered, all the pieces best fit together, and if this is fully supported by our elected representatives in Government, that sets out the need case, starts the process and gets construction underway.

Chair: Let us go to Vicky.

Q467 **Vicky Ford:** I have so many questions I almost do not know where to start, but I am going to start with gas. At COP, we and countries all over the world signed up to transition away from fossil fuels. How is that commitment to decarbonise power and reach net zero compatible with keeping unabated gas power stations going until 2035?



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Professor Bell: As you imply, the first thing we need to do is use as little unabated gas as possible. There is of course the transition of the whole infrastructure that we have to go through, as we just said. However, we also need reliable supplies of electricity.

Vicky Ford: I understand that.

Professor Bell: The potential reason for keeping unabated gas plant available is for the cases where you need it for security of supply. It is the least bad way of ensuring security of energy supply, and the volume produced on an annual basis should be very small. There is an associated cost of maintaining the infrastructure, so by 2030, 2035, we may well still have a number of gigawatts of unabated gas capacity, but we should not have—

Q468 **Vicky Ford:** Should that be less than 5% of our use?

Professor Bell: In terms of energy use, it should be no more than 2% or 3%.

Q469 **Vicky Ford:** But on dunkelflaute days, it will be higher?

Professor Bell: Exactly. It is almost an insurance policy.

Q470 **Vicky Ford:** If you had to upgrade or do work on a gas power station, it would feel like throwing good money after bad because eventually these are going to go. Will there be a need to upgrade or invest in any of these in order to keep them going?

Professor Bell: I am not expert enough to know how the degradation or maintenance of the plant will go if we are using it less, although if this were the case, it may be ramping up and down a lot more of the existing plant. Quite what that means for its lifetime, I am not sure.

Q471 **Vicky Ford:** You are not sure if any interventions are needed?

Professor Bell: Some refurbishments might well be necessary, but we also need to take account of what comes to replace it, looking ahead to new gas plant that should be hydrogen ready and/or CCS ready.

Q472 **Vicky Ford:** Is it possible to convert all our existing gas power stations into either hydrogen or gas power to CCS?

Professor Bell: In terms of hydrogen, I do not know. In terms of CCS, I do not think so.

Vicky Ford: Craig, do you know?

Craig Dyke: I am aware of a new facility that has just been awarded a contract in the capacitor market, which will start as an abated gas facility but has the ability to convert to hydrogen.

Q473 **Vicky Ford:** Is that new?



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Craig Dyke: With existing fleet, I would imagine it would have to be looked at on a case by case basis.

Q474 **Vicky Ford:** I would be really interested to know if that is possible. Given that we want to have as low as possible gas use with as low as possible carbon emissions, and given that gas producers all across the world signed up to say they would stop venting and flaring, how important is it that we stop this practice in our own North sea?

Professor Bell: It is very important.

Q475 **Vicky Ford:** I just might have worked with Alok Sharma to table the amendment on venting and flaring and might be one of the few members of this Parliament who has been offshore to a sea oil and gas rig. How convinced are you that our North sea is going to have zero venting and flaring and meet that international commitment by 2030?

Professor Bell: I am not very convinced at this stage. I am aware of some discussion that colleagues in the CCC have had with parts of the industry, where there is a difference of opinion, or so we are told, about what is practicable by 2030.

Q476 **Vicky Ford:** I do not want to put words into your mouth, but are you about to say that it would be very interesting if this Committee could recommend that Government produce a platform-by-platform, installation-by-installation report on how they are going to meet that 2030 commitment?

Professor Bell: That would be very interesting to see.

Q477 **Vicky Ford:** Could you recommend that we do this?

Professor Bell: I would recommend close attention to how the North sea gas industry might reduce its emissions platform by platform.

Q478 **Vicky Ford:** Do you mean might or will, because they have committed to zero routine venting and flaring by 2030?

Professor Bell: I mean will. That is a good clarification. I will be very interested to see how they will do it.

Q479 **Vicky Ford:** Thank you. That would be very helpful. You just spoke about electric cars and how important they are in managing demand. One of my bugbears is that if you live in a big house with a drive, to charge your car using your home electricity you pay 5% VAT. If you live in a terraced house, and you have to use a commercial charger, you pay 20% VAT. This does not feel like levelling up.

Professor Bell: Correct.

Vicky Ford: How many hours is it to the Budget?

Chair: It is a couple of hours.

Q480 **Vicky Ford:** If the Chancellor does not announce a levelling up of what I



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call ending the pavement tax in this Budget, will you look at the impact of this drag on EV demand from those in terraced houses as part of your work?

Professor Bell: Yes. Access to reasonable cost electric vehicle charging for those who do not have a driveway is absolutely essential. We have to address that. The earlier question hinted at that as well. It is part of the infrastructure to enable the energy transition, which has to be priced fairly, developed at pace and also be well maintained. For example, we have heard various stories about commercial EV chargers that are not always in service when you get there. Can we leave this entirely to the market to sort out? I do not know, but the kinds of imbalances you are suggesting would appear to be not very helpful.

Q481 **Vicky Ford:** With some terrace houses, it is relatively easy to park outside your own front door every day. With others, where you have a race to park, it is less easy. Are you saying that we might want to consider a recommendation to have not just more chargers but more reliable chargers and to make the system interoperable, so it is relatively easy to use one brand versus another, and that they be well-maintained and so on?

Professor Bell: That all sounds good to me.

Q482 **Vicky Ford:** Thank you. I am always focused on the recommendations. I want to quickly talk about burning wood. It is not on my list of questions, but Drax is a rather topical issue. How compatible is it with our net zero emissions to be burning wood that has come from the other side of the Atlantic in great big ships?

Professor Bell: I am personally not on top of the latest evidence. In the past, we were assured that, on balance and all things considered, this was a sustainable resource. Of course, things have come to light in more recent times to suggest that it is not, but I am not going to commit to saying anything definitive on that other than to express concern. One thing the CCC has said is that with any large-scale support of biomass for the generation of electricity in the next, say, five years, there must be a clear move towards the capture of the associated CO₂ emissions, so that we get a sustainable BECCS sector going, if we are to support bioenergy for electricity.

Q483 **Vicky Ford:** When Drax came here, they tried to say that it does not really matter, because every time they cut down a great big tree, they plant a little tiny sapling, so eventually, it is all going to be carbon-neutral. That is clearly not the case, is it?

Professor Bell: As I say, I am not familiar with the latest evidence.

Q484 **Vicky Ford:** They also tried to make a case that they are not cutting down great big trees but removing brushwood from forests, enabling firebreaks to stop forest fires, and that all that spare wood is a valuable source. You may not be an expert, but you are a member of the Climate



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Change Committee. Would you agree that taking away wood that could be a fire risk—and we want to stop forest fires—would be a sensible thing to do, in principle?

Professor Bell: In principle, this is all part of rational, sustainable management of forests and woodland. As I understand it, there is a whole stage of processing whatever product it is, then how you move it around and how you use it. If in all that you are removing wood in terms of the woodland management with a net balance of emissions, then it would appear to be okay.

Q485 **Vicky Ford:** The devil is in the detail.

Professor Bell: I put lots of caveats in there, but the devil is in the detail, which is why I am afraid I am not the right person.

Vicky Ford: As I said, I was only meant to be asking about gas power stations, but I have gone on to a few other areas. It has been interesting and helpful. Thank you.

Chair: Thank you, Vicky, and thank you to our witnesses for contributing to our inquiry. We are going to suspend the session for a moment or two in between the two panels. Thank you very much.

Examination of witnesses

Witnesses: Tim Ambler, Professor Robert Gross, Dr Doug Parr and Professor Jim Watson.

Q486 **Chair:** This is the second part of our session on the future energy system. Would each of our witnesses just tell us who they are and the organisation they represent?

Tim Ambler: I am Tim Ambler, from the Adam Smith Institute.

Professor Gross: I am Robert Gross, director of the UK Energy Research Centre.

Dr Parr: I am Doug Parr, policy director at Greenpeace UK.

Professor Watson: And I am Jim Watson, director of the Institute for Sustainable Resources at UCL.

Q487 **Chair:** Thank you. I will make a quick point, which I know Vicky would want us to make: we have six witnesses today, all of whom are gentlemen. We really would urge the industry, when it brings witnesses before this Committee, to see whether some greater sense of diversity can be provided. The point is on the record.

Gentlemen, each of you listened to the first session. Does the Government's current approach strike the right balance between the emerging technologies we know are becoming available and retaining flexibility in order to give us a long-term supply? Mr Ambler, if you could give us your thoughts on that topic, please?



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Tim Ambler: The answer is quite simple: no.

Chair: Would you elaborate?

Tim Ambler: I have my aide-mémoire notes for myself here, but I was not aware of the time problem. It might be helpful for the Committee to see what I would have said if I had been allowed to say it.

Chair: Can you summarise your views?

Tim Ambler: Yes, would you like a copy of it?

Chair: Yes, absolutely, if you would share that with the Committee, but just give us a quick summary of where you see this.

Tim Ambler: The Department for Energy Security and Net Zero has 4,217 civil servants who should be capable of simple arithmetic but appear not to be. What we have done in our team of five people—rather fewer than 4,217—is what the Government should have done: publish a plan of what the energy market would look like in the year 2050, which is what we understood this inquiry to be about. Basically, wind and other renewables have to take the prize as the most important source, and much of that is new, although not that new. Our analysis started by asking how much can the renewables supply? The answer is somewhere between 40% and 50%. It is nothing like as much as some people would have us believe.

Q488 **Chair:** So your case is that the Government are overstating the amount of our energy sources that come from wind?

Tim Ambler: The Government are not saying anything because they do not have a plan.

Q489 **Chair:** May I turn to Professor Gross, then Dr Parr, please?

Professor Gross: The Government are beginning to get some things right, which is laudable. There has been a really clear pivot towards the recognition that the system infrastructure in particular needs to be planned. The Strategic Spatial Energy Plan is a welcome development. Clearly, we are no longer in a world where we can be technology-neutral and Government can leave everything to the market; that ship has completely sailed. We are in a transition phase where we are trying to build out renewables. You have already heard about some things that are being done less well and, in particular, the Government are falling behind on heat system decarbonisation.

To jump to the good bit: we cannot take gas off the bars until we have enough flexibility provision from other sources. That is certainly unlikely to happen by 2030, even by 2035; therefore, we need to be thinking about the extent to which gas is a strategic reserve and needs to be kept operable until no longer needed. I will pause for my colleagues.



Dr Parr: On the question of balance, there are certainly some things going well, but there are a few things not going so well. There needs to be a considerable emphasis on the delivery of offshore wind, onshore wind and solar, with the associated grid infrastructure to transmit it from the places where it is generated to where it is needed. That is a delivery thing where the Government need to be de-risking the investment as far as possible. There is an innovation space, and the two areas I would point to are around storage, particularly long-term storage, and in demand-side response, where they need to be looking to free up and reduce regulation to give opportunities for technologies to come through and, in certain cases, drive innovation through funding.

There is a third area where there is clearly overemphasis compared with what is required. We believe we should be aiming for a 100% renewables system. I cannot for the life of me see why the Government are so enthusiastic about nuclear, given the product is so rubbish long-term and over-expensive. Also, we will certainly need some carbon capture and storage but as you will tell by a brief glance at me, I am not in the first flush of youth and I was talking about carbon capture and storage in the late '90s. We are now probably closer to net zero time in 2050 than when we were first having conversations about its significance. Globally, it has delivered very little and to put an over-emphasis on that as a key part of the overall answer seems extremely optimistic to me.

Q490 **Chair:** We have differing views emerging already. Professor Watson?

Professor Watson: Yes, to what Doug and Rob have said I would just add that, broadly, some things are going in the right direction; we are making a lot of progress. For example, looking at the Government's energy security policy statements over the last couple of years, if anything, they are focusing, on the supply side on too many long-term options and not enough on the short-term options. I would like to see them doubling down on the wind, the offshore wind and the solar. Of course, with the battery storage and all the flexibility you need to go with it—as you discussed with the previous panel—there is a temptation to fund nuclear, hydrogen, things that are going to deliver in the 2030s onwards, but we really need to accelerate the stuff that is going to keep delivering now.

The other thing I would add is on the demand side: Government are not doing anywhere near enough on the energy efficiency agenda. I know that is not necessarily in the scope of this inquiry but, if you are going to have a strategy for the future of electricity or energy as a whole, energy demand has to be at the centre of it, and it has to be the first thing you address.

Chair: A holistic approach. Lloyd Russell-Moyle?

Q491 **Lloyd Russell-Moyle:** How could the Government improve how they co-ordinate policy on decarbonising energy for electricity, heat and transport? Effectively, that is following on from the question: what do the



Government need to do?

Professor Watson: Again, you talked to the last panel about this. There are lots of things the Government need to do, but the thing I would really emphasise is making that decision on heat allied to upgrading our housing stock. So, it is about upgrading the housing stock which, of course, is happening, especially for some low-income homes under current schemes, but the scale is not enough. The Government have really missed an opportunity with the energy crisis over the last couple of years to scale that up and then link that to a decision on heat.

Q492 **Lloyd Russell-Moyle:** What savings does that actually achieve for us in terms of demand?

Professor Watson: In terms of overall demand, the Energy Demand Consortium, a research consortium in the UK, has done scenarios of up to 50% reduction in demand, which is quite eyewatering over the period to 2050. Personally, I am a little sceptical you can get that far, but certainly within the 25% region. They have done a lot of analysis looking across the economy of the kind of reduction that could be delivered.

Q493 **Lloyd Russell-Moyle:** I know it is not for this inquiry, but we have another inquiry on the same topic, so it is useful to get the wider discussion. For the ordinary person, what does that actually entail them having to do at the moment, and what should they have to do in the future?

Professor Watson: Personally, I would not put it quite like that in terms of an ordinary person having to do something.

Q494 **Lloyd Russell-Moyle:** At the moment, an ordinary person has to try to find a supplier, try to find a bid stream they might or might not get. They will probably not find a supplier that matches up with government money and they will probably give up or, if they are wealthy enough, they will pay for it out of their own money, but most people will do nothing. That is what the ordinary person does at the moment, and we have no progress. What I meant by the ordinary person is: what are the barriers to achieving that?

Professor Watson: It is information; it is access to the right skilled people. Clearly, for most people, it is access to money to upgrade their home and invest in a new heating system. That was the point I was going to make. The Government ought to say electric heating is the lead option now. We are not going to keep pretending it is a choice on a national level between that and hydrogen because all the evidence shows electricity is probably the front-runner. There are examples from France, Ireland and other countries where you have really good, actively well-funded agencies that can help people through that journey—identifying suppliers, even project managing upgrades of their home, and doing all the things they need—because, at the moment, it is a very difficult thing for most households to navigate.



Dr Parr: I concur with that. Our model of how we go about reducing gas use in the majority of homes is to hope every homeowner is going to make themselves an expert in the energy system and on energy technologies. We have proposed a warm homes agency, which does a number of things, including independent advice, support and redress where necessary, where poor workmanship has been delivered, so there is something that looks like a decent consumer journey. That agency could be staffed by people who really know the industry and know what is going on and help with the skills buildout that is going to be necessary to make sure there are enough people in the supply chain who are able to do the job and, as I say, deal with poor workmanship or give confidence to people that poor workmanship is likely. Where there is a more structured approach to being able to deliver efficiency and changes in heating systems, such as through local authorities and large social housing providers, we see they can take those decisions and deliver it, but for individual homeowners it is much more challenging.

Q495 **Lloyd Russell-Moyle:** Robert, do we need a similar kind of approach in all areas where you have agencies that specialise? Focusing on the rollout—looking at transport, looking at homeownership—how do the Government deliver that change?

Professor Gross: There is a particular case for this kind of agency or information-providing central body for home energy efficiency because of the multiple market barriers, obstacles and information gaps. No, I do not think it is the same at all.

Q496 **Lloyd Russell-Moyle:** What Government intervention do we need in other areas of the market to make it work?

Professor Gross: What we are talking about is electrifying the two-thirds of final energy use we currently get from burning stuff: burning gas in our houses; burning petroleum products in our cars. I do not think it is feasible to electrify those two-thirds of energy services if electricity itself is not sufficiently affordable. You have touched upon some of the issues around what percentage VAT you might pay for electric vehicle charging. If you stop at a motorway service station and you do not have a Tesla, you can pay anything in the range of 50p to nearly 90p per kilowatt-hour for a fast charge. That is far too expensive. That makes running an electric car as expensive or more expensive than running a car on premium petrol.

We have a huge strategic opportunity to deliver affordable electricity using, in particular, our resources in the North sea, and by ensuring we get this buildout of low-carbon generation delivered at the lowest possible cost, and at the lowest possible cost of money, so the lowest possible rate of interest. That has to be the major strategic objective for the Government if we are going to do this decarbonisation electrification journey. That is a fundamental prerequisite, and it is very much overlooked.



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Q497 **Lloyd Russell-Moyle:** The focus needs to be on bringing the price down. Tim?

Tim Ambler: Your Committee launched an inquiry yesterday on this very subject, to which we will be responding but, in a nutshell for now, the answer is privatisation. The energy market has never been privatised, although there has been much talk of it. We will be putting forward answers to your questions as part of that inquiry.

Q498 **Lloyd Russell-Moyle:** That seems to be completely the opposite of where we are going: the Future Service Operator coming back in-house.

Tim Ambler: Yes, it is.

Q499 **Lloyd Russell-Moyle:** Because privatisation is there, but I will read the paper with interest when you send it to me.

Tim Ambler: Unsurprisingly, this Government are entirely wrong, as they are on quite a lot of things. I recommend you read my notes because you will not have chance to hear but, in a nutshell, Greenpeace is completely wrong that nuclear is some sort of fad; it is an essential part. In 2050 there will be three sources of energy or electricity. The main one, we agree, is renewables—between 40% and 50%—because, amazingly, as Greenpeace will discover, the wind does not always blow, nor does the sun always shine. Therefore, you need nuclear to about 30%, and you need fossil fuels with carbon capture and storage. The Government are exceedingly slow on both those things. Given the fact both those things are absolutely crucial to having net zero by 2050, it is astonishing they would spend their time fussing about other odds and ends. I accept the price of charging your car on the forecourt is important but, compared to those strategic issues, they are not important, and those are the three things that really matter.

Chair: Okay, thank you. Let us go on to Vicky Ford.

Q500 **Vicky Ford:** On this journey towards getting less from burning and more from wind blowing, nuclear and so on, what new energy security vulnerabilities will we have, and what do the Government need to be doing now to address those? Robert?

Professor Gross: The new vulnerabilities will be around the variability of renewables. In my view, we will continue to be exposed to gas price volatility, so we should not separate physical security from economic security for as long as we need to burn gas in order to keep our system reliable, and you heard from previous colleagues that that is likely to be the case for some years to come. The fundamental requirement is that we need new network infrastructure so we can connect to places where the renewable resource is strongest and where we have the opportunity to do renewables at scale. That is the thing we have been falling behind on. To the extent to which there might be future vulnerabilities, those vulnerabilities will be associated with our inability to deliver the network assets we need quickly enough.



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Q501 **Vicky Ford:** Always trying to move the power from the power source towards the demand, especially when it comes to renewables?

Professor Gross: Yes.

Q502 **Vicky Ford:** Are the Government doing enough to try to encourage the demand to move closer to the supply?

Professor Gross: I do not think it is feasible for that to happen because it is windy in the North sea. There are not many people living there. It is easier to build wind farms in—

Vicky Ford: Not necessarily people but—

Professor Gross: No, I do not think it is possible. We need to strategically develop the network. In the same way that we built a network for coal by wire in the 1960s, we need to build a network for wind by wire now.

Professor Watson: I just wanted to come in on your security question. Rob has identified some of the risks, but there is also a risk with making sure the gas system continues to be secure as we use less and less of it. If people are moving off gas to electric heating, you are using less gas—as Keith was explaining in the first session for electricity—but you are still going to have to have a reliable gas network, and you are going to have to pay for that with fewer customers. I do not think Government have a strategy yet for how they are going to manage that. How are they going to pay for a network which is in declining use? That is the second thing I would add.

Thirdly, cybersecurity and digitalisation: it is not something people put on record very much for very obvious reasons, but as we electrify more and more things and things are connected, cybersecurity becomes more and more important. The final one is minerals and critical minerals. It is not the same as oil and gas security because the minerals get embodied in the technology. It is not something we need as a fuel on an ongoing basis, but we still need to think about the security and how that gets embodied in the products.

Q503 **Vicky Ford:** So reminding the Government they need to be mindful of all those other issues is something we could definitely mention in our report?

Professor Watson: Absolutely right, yes.

Dr Parr: I will try to add to what has already been said. First, recognising demand is an important part of security as well. Far too much focus is on security through supply and not enough through demand. That applies to critical minerals as well. We need some infrastructure to start recycling the minerals we have imported to the UK.

On other aspects of reliable electricity supply, to some extent these are matters of choice. For the last couple of winters—and many previous—when the price has been extremely high, our economic security of the gas



system has relied on the storage of gas going on in continental Europe because we have very little storage here. We import quite a bit of electricity, almost on a daily basis at the moment, and we are not too exercised about that. However, I would recommend the UK invests in long-term storage for when the wind does not blow and the sun does not shine—as we have been perfectly well aware of for a very long time—as a challenge in the 100% renewables system. We can contribute to the global technology push around things like green hydrogen, the flow of that green hydrogen, fertiliser and so on, into other sectors, but also into the long-term storage of electricity that we are going to need.

Q504 Vicky Ford: Clearly, over the past two years since Ukraine, we have really understood how insecure our energy supply is with what has happened with energy prices. In a net zero world, do you think our power supply, our energy supply, our electricity supply, will feel more secure?

Dr Parr: It could do. It depends on the sort of actions we have been talking about: how fast we build out the North sea; how fast we build grid.

Tim Ambler: It is an exceptionally good question. The storage of electricity in one form or another—batteries, hydrogen or whatever it might be—is important, but it has been greatly overhyped. It has been said we can rely on the continent but, if you want a number, we import 12% of our energy needs from the continent. My central point is the Government are not sufficiently preoccupied with the numbers. They have not done the arithmetic; they have not published the arithmetic; and we need to see the arithmetic. If they have the numbers, they should not be kept secret because a lot of the debate we are having this morning depends on the numbers and it is all fairly meaningless if we do not know what they are.

Q505 Vicky Ford: I can see you are a mathematician—as am I—so let us leave it there and pass on to the next person.

Professor Gross: The answer to your question is: yes, it will be more secure with more stable prices. There will be a transition. We should not make the presumption we can get, for example, the new hydrogen interseasonal storage available. We have an energy security risk if it is not delivered on time. We need to rely on gas and keep the gas system available until we do not need it any more. When we reach that destination point, we can absolutely have a more secure and more stable-priced energy system.

Q506 Chair: We are going to need to conclude in two or three minutes, so I would like to ask each of you if there any issues you believe we should hear about that you have not yet told us in your evidence. Mr Ambler?

Tim Ambler: Regulation is a very important point: in the pricing—which we will come on to in your new inquiry—but also the slowness of nuclear provision which is due to unnecessary regulation more than anything else.



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Professor Gross: There is a place for nuclear. I do not think we can expect to get more than one or two reactors per decade; we need to be realistic about that. For me, it is all about timelines, sequencing, and ensuring we look after the legacy assets infrastructure we have for as long as we need it, while building the new infrastructure for the net zero future.

Dr Parr: As it was touched on in the last session, I would like to make a point about biomass. I do not think the current model of mass burn of wood can ever be sustainable. The model of trying to turn something into a commodity, ship it from various places in the world and have some kind of business certification—

Chair: That is the point that Vicky Ford was making earlier.

Dr Parr: Yes. We have tried it. We tried it with soya; it failed. We tried it with palm oil; it failed. We tried it with fish—

Vicky Ford: We have the point.

Professor Watson: A couple of quick points: on nuclear, the model we are pursuing with Hinkley C and Sizewell C is not really going to deliver very quickly. Clearly, it is very expensive. I do not mind if the Government want to try the alternative, the small modular reactor approach, but we have to be very careful not to believe the estimates of how much they are going to cost until we have built one, or two or three. On biomass, I agree we need proper sustainability standards, but if we are going to continue to have things like Drax—

Q507 **Vicky Ford:** I am just going to ask a really quick last question because we have two professors, a doctor and a mathematician: you must look at international comparisons. In terms of how the UK is performing versus other countries, would you say we are in the top quartile, bottom quartile or somewhere in the middle? Jim?

Professor Watson: It depends on what sector you are talking about.

Q508 **Vicky Ford:** Oh, come on. It is the UK on the whole.

Professor Watson: On average, we are in the middle.

Dr Parr: CO₂, good; spend for the transition, poor.

Professor Gross: We are definitely in the top quartile for renewables, and we were the leading offshore wind country for a number of years.

Tim Ambler: Yes, I agree with that. Amazingly, I also agree with Greenpeace about biomass. The nuclear future is these SMRs we have spoken of. We calculate we are going to need 70—seven zero—SMRs by 2050, which is doable, we explain how, and the Government are tentatively ordering one in four years' time. One, not 70! It is pathetic!

Chair: Thank you all for your evidence today. As we are about to become



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inquorate, I am afraid I am going to have to end our formal proceedings.