



Science and Technology Committee

Corrected oral evidence: The role of batteries and fuel cells in achieving net zero

Tuesday 8 June 2021

11 am

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Members present: Lord Patel (The Chair); Baroness Blackwood of North Oxford; Baroness Brown of Cambridge; Viscount Hanworth; Lord Holmes of Richmond; Lord Kakkar; Lord Krebs; Baroness Manningham-Buller; Lord Mitchell; Baroness Rock; Lord Sarfraz; Baroness Sheehan; Baroness Walmsley; Baroness Warwick of Undercliffe; Lord Winston.

Evidence Session No. 15

Virtual Proceeding

Questions 165 - 177

Witnesses

Rt Hon Anne-Marie Trevelyan MP, Minister of State (Minister for Business, Energy and Clean Growth), Department of Business, Energy and Industrial Strategy (BEIS); Rachel Maclean MP, Parliamentary Under Secretary of State, Department for Transport (DfT); Dr Bob Moran, Deputy Director, Head of Environment Strategy, Department for Transport (DfT); Hannah Boardman, Director of Advanced Manufacturing, Department of Business, Energy and industrial strategy (BEIS).

USE OF THE TRANSCRIPT

This is a corrected transcript of evidence taken in public and webcast on www.parliamentlive.tv.

Examination of witnesses

Rt Hon Anne-Marie Trevelyan MP and Rachel Maclean MP.

Q165 **The Chair:** Good morning, Ministers. Thank you very much for finding time to join us today. I and the committee are very appreciative of you making the time. This is our last session, and it will be really interesting hearing from you about the Government's proposals and look ahead on battery and fuel-cell technologies. We are doing this inquiry knowing that the Government have strategies related to batteries and fuel cells, and that they want the United Kingdom to be a leader in this field. Our inquiry, having taken evidence from a wide spectrum of people, is about trying to help that process. We are not doing this exercise just so we can put you in the dock and question you, Ministers. We are doing this to be helpful, to add to your strategy in a meaningful way. I hope when we produce the report you will see it in that way, and that your response will therefore be in that mode. That is what I want to say.

I will kick off with the first question, to Minister Maclean. How do the Government intend to address the challenges leading up to the electrification of motor cars by 2030 and the challenges they face with supply chains, resource materials, and manufacturing and charging points? If you fail to address those challenges, what might the effect be on car manufacturing industries?

Rachel Maclean: Thank you, Lord Patel. First, thank you very much for inviting me to appear in front of your committee. It is a real privilege to be with so many distinguished scientists and members of the committee. I very much welcome the report that you are doing, and I will definitely be pleased to read it. You are right to say that this is a huge priority for the Government.

Your question covered a range of issues. I will start by focusing particularly on the transition to zero-emission vehicles by 2030 and 2035, which is the bit that is mostly in my remit. As you know, we have made an announcement to phase out the sale of new petrol and diesel cars by 2030. We are currently consulting on exactly what that means for hybrid vehicles, which will also need to be phased out by 2035. Those consultations are taking place at the moment, and we are taking views from industry and others about exactly what that zero-emission capability will need to be.

I heard some of the earlier questions. I am sure that some of your concerns and thoughts are about the infrastructure that is required. Forgive me if I am talking about things that you do not want me to talk about, but the infrastructure piece is always really important, and I heard one of your committee members talking about charging points earlier. I am very happy to make a few remarks about that.

It is vital that we have the charging capacity on the network to make sure that this transition can take place, because clearly no one will buy an electric vehicle or transition to one, first-hand or second-hand, unless they are confident that they can charge it. Range anxiety is a real thing,

but we find that it usually diminishes once people have an electric vehicle and realise that they can charge it at home while they are asleep, which is a massive plus compared to a petrol or diesel vehicle. As Bob said, I have had an electric vehicle now for over a year, so I have experienced all the good and bad of having that.

The Government do have a plan. Clearly we are not where we need to be now. This is a new market. It is only just starting to take off, but it is taking off very fast. We are seeing vehicle registrations for electric vehicles increasing rapidly at the moment, and that is partly driven by some of our generous government grant support for people who want to purchase an electric car. It is partly driven by the fact that our world-leading automotive industry is responding to the market and producing more models that are better, go faster, have batteries that last longer, have greater range, and the prices are coming down, which is absolutely vital. We are seeing that rise in demand, and it is great that the industry is responding, but we clearly also need, in the Government's perspective, to make sure we have a strategy for those charge points to be in the places they need to be.

There are a number of problems that we are tackling. The first is people who do not have driveways or off-street parking. We have a lot of work going on looking at how local authorities can ramp up their provision. We have government money available for the on-street charging provision. Not all local authorities are taking that up to our satisfaction, so we are working at pace with them to help and support them to drive that provision. You will see that in some areas it is very good; in others it is non-existent.

Secondly, we are working very closely with all the providers on a strategic road network and the motorways, so that we have the plans set out to make sure that we have those chargers where people are doing those longer journeys. That is underpinned by over £1 billion worth of government funding to make sure that we can tackle some of the connection barriers and the power generation barriers at those larger sites. We see more and more of those already coming on stream with the market responding as well.

The other issue, which I heard a member of your committee mention, is compatibility. At the moment, we have a bit of a mixed picture. We have charge-point operators slightly doing their own thing. Some of them require you to sign up to an app and so on, which is suboptimal. We have done a piece of work, a consultation, on that, which we have broadly called our consumer experience piece. We will be ready to lay regulations on that and we will require all charge-point operators to have a simple, standard contactless payment mechanism. There are a number of other things that we are also requiring them to do to make sure that they are fully accessible to people with disabilities and other impairments, and a whole host of other things. Basically, it has to be just as easy for people to fill up their electric car as it is at the moment to fill up a diesel or petrol car.

So, yes, the infrastructure is not there right now. This is an early market, so it is right that the Government are going in and stimulating the market. It is also right that we do not get in the way of the private sector, which is also rapidly coming into this market because it is now seeing the return. We will publish an infrastructure strategy, with a lot of detail in it exposing all these concerns and queries, before we rise for the Summer Recess. I will leave my remarks there, Lord Patel. Please feel free to come back to me.

The Chair: Thank you very much indeed.

Q166 **Baroness Blackwood of North Oxford:** We have just heard from Hannah Boardman that, while we are doing very well in a number of areas, we are doing less well in fuel cells. Indeed, from a number of our witnesses we have heard that we have excellent research and some manufacturing in fuel cells and electrolysers, but we have a small domestic market. On the plus side, though, no single country is dominating this market so we have the potential, if we get the policy right, to own this market and take a larger role internationally.

I would like to understand why fuel cells are receiving less attention in UK policy to date compared to battery technology, and whether perhaps a deadline for phasing out diesel in heavy transport would provide the same motivation for this market that decarbonisation has provided for light-duty transport. Perhaps you would tackle those questions, thank you.

Rachel Maclean: Thank you very much. The first thing I want to stress is that the role of hydrogen generally, including in fuel cells, is not receiving less attention in government policy-making. It is certainly not in my department, or in the department that Minister Trevelyan is from. I am sure she will talk about this, but she is leading on a big hydrogen strategy that will set out a government approach to hydrogen across the board. We in DfT will shortly be publishing our transport decarbonisation plan, which sets out how we will decarbonise every mode of transport.

Throughout the DfT, we are technology agnostic. We do not say, "You must use this particular power-generation method to decarbonise this particular mode of transport". We are absolutely working to invest in R&D in all potential methods of decarbonisation. We want to reach the end goal. We have to reach the end goal. Some methods of that are more advanced, such as batteries for lighter vehicles, but we know that that will not be enough to decarbonise some of the heavier modes of transport. That is why we are focusing a lot of work and R&D stimulus into that hydrogen market, whether it is fuel cells or other methods of hydrogen propulsion.

Specifically on fuel cells, we have a £23 million Hydrogen for Transport programme, which is increasing the uptake of fuel-cell electric vehicles, and delivering new refuelling stations, and we have been supporting some public and private sector fleets to become early adopters through another programme, which is a £2 million fuel-cell electric vehicle fleet support scheme. That rolled off the tongue.

More broadly, we have also recognised that there is a real need to look at the role of hydrogen in transport. We have set up the world's first hydrogen transport hub in Teesside. We set that up last year, again, backed by government funding. We are working through our plans for that, but we see that as playing a major role in helping us to understand the role of how to bring together the whole supply chain and the production of green hydrogen; we do need to make sure that it is green, and you will be aware that there are challenges to producing green hydrogen at scale. We are working through those challenges in order to have this fuel ready to be able to power some of those heavier vehicles where we see hydrogen playing a role in the future.

Baroness Blackwood of North Oxford: Thank you so much. Minister Trevelyan, do you want to come in on the hydrogen strategy, which will obviously be critical in responding to this?

Anne-Marie Trevelyan: Absolutely. Thank you very much indeed, Baroness Blackwood. To the question of whether the fuel-cell work and investment is as far advanced, the production of hydrogen is still very costly. Everyone, not only the UK, is further behind in that than in the car and van battery technology. We are working at pace with that, as are many other countries. Thinking about fuel flexibility, Minister Maclean's point about being technology agnostic is still really important at this stage, allowing industry and R&D to stretch their wings and look at all those different areas—not only hydrogen fuel cells but ammonia and how that might work with maritime biogas and biomethane. The sector is still learning what it can do.

Importantly, the fuel cell is an opportunity to displace the incumbent high-carbon fuels, in mobility but also in industry and in other ways, in the power sector. The hydrogen strategy is very focused on the challenges that there still are with reliability and scale up. It will be the first hydrogen strategy anywhere in the world, and we are drawing together knowledge, experience, and technical innovation from across the board. If you have had anyone before you from the hydrogen industry side, you will know that they are absolutely passionate about the potential they can see, and it is very important to us that the hydrogen strategy affords space and support to help drive that.

At the moment, a hydrogen innovation road map is being prepared for the Net Zero Innovation Board. That fundamental research for fuel cells is being led by the H2FC SUPERGEN research hub, which is funded by the research councils and led by Imperial College and Loughborough University. It draws together universities that have that fuel-cell research capacity to try to align those research objectives and share techniques, so that we are driving this at full pelt with everybody's technical expertise to push it forwards. Interestingly, I visited JCB a couple of weeks ago, which has hydrogen vehicles—great big diggers; diggers of all sizes, small to large. It is testing this now exactly for that question: to see if it can demonstrate that it has that reliability and scale-up challenge. There is a huge amount of energy in this space.

Q167 **Baroness Blackwood of North Oxford:** Thank you. We are all

impatiently waiting for the publication of the hydrogen strategy. An indication on the date would be great, because I think it was due in the spring.

My final question is: what level of co-ordination is there between the hydrogen strategy and the particular question of government support for the development stage, rather than the research stage, of fuel cells and electrolysers—particularly the manufacture at scale, because that is where we would be globally competitive, if we really invested and accelerated our investment?

Anne-Marie Trevelyan: The hydrogen strategy is very much a cross-government strategy. Publication before the recess is still absolutely our intention. We published the industrial decarbonisation strategy in March, and there will be the heat and buildings strategy as well. These are all critical to the net zero strategy, which we will publish before COP in the autumn.

The strategies are fundamental pillars to the overarching net zero strategy that we will be putting forward. The hydrogen strategy is looking across government but led by the initial focus that we have taken, which is on the production side. As Minister Maclean said, we are going for the two-pronged approach: the blue hydrogen technology and the CCUS, alongside green hydrogen technology development. However, at the moment, green has to use a renewable, clean-energy source in order to be produced, so the quantum is not there yet around the piece. Having blue hydrogen in the shorter term will afford the opportunity for that demand side to grow. The strategy is very much looking across the piece. We have the opportunity to do that by nature of our geology and our oil and gas industry with the CCUS, so we are able to run both in parallel to make sure that we maximise that output.

Q168 **The Chair:** Minister, we have the Faraday Institution, and we now have a battery industrialisation centre about to open. Do you think we need a similar kind of organisation for fuel cells? Yes or no.

Anne-Marie Trevelyan: That is a very interesting question. The Faraday Institution is an independent institute looking at electrical chemical energy storage research, skills, market analysis for early-stage commercialisation, and it is bringing together a number of things. A lot of the work that has come from BEIS in helping on the blue hydrogen side in building that CCUS and working with heavy industry to help them to be able to abate their emissions has grown from that side. But that is a very fair challenge, Lord Patel.

Q169 **Viscount Hanworth:** I will address this question in the first instance to Anne-Marie Trevelyan. There is a considerable variation in the demand of electricity over the day, over the week and over the year. If demand is to be met largely from renewable sources, which are intermittent, there will be a requirement for the storage of electricity, or at least of the energy required to produce it. What advice have you received regarding the role that battery storage might have in meeting this requirement and whether

batteries need to be developed to meet the requirement specifically?

Anne-Marie Trevelyan: This is an absolutely integral part of this enormous change that we are bringing to our whole energy system. Historically we have had a few very large producers of electricity, and indeed gas, but now we are looking to have a very widely distributed system in big form. As Minister Maclean said, we have the opportunity to harness the battery storage capacity of vehicles when they are not being used, alongside thinking about how we hold that energy produced from renewables when, as you say, it is not available.

That wide mix of storage opportunities, from hydro, which we have quite a lot of now but it is not a major part of our storage capacity, through to others is an absolutely integral part of that conversation, as is thinking about how we can use hydrogen in a much larger way to help as part of that storage.

There is a lot of early commercialisation thinking going on in that space. We are doing something really revolutionary in the way we are shifting. We have enormous wind—renewable—potential, and we have taken the decision to push to a 40-gigawatt capacity of wind generation by 2030, and if you look at the modelling to 2050, we have something like 100 gigawatts of wind. The opportunity to harness that when, as you say, it is windy, and to be able to hold it so that we can use that energy when we, industry and consumers need it will be a really important part of commercialisations that solution.

Viscount Hanworth: Are you suggesting that hydrogen could be one way of storing energy?

Anne-Marie Trevelyan: Absolutely. That is very much one area where there is a lot of thinking and early work going on about how that might be well-used.

There is a really interesting challenge, and Ofgem has done some initial figures. If we assume that everyone will want to charge their cars all at once on the same day, and we all had our heating on, the amount of capacity required would be enormous. But, of course, that will not actually be the case, so we want to design a really flexible system, a really smart system, that can maximise the renewable energy and storage of it to make sure that the consumer and business do not have the highest cost but we are getting the most efficient cost and energy efficiency, as well as financial efficiency, out of our renewable industry.

Viscount Hanworth: It has been suggested, as you acknowledged, that vehicle grid transmission might play a role in addressing the variability of demand for the supply of electricity. However, it seems that the availability of such a supply would be ill-matched to the demand. At least, that is the opinion that we have heard from some people. I will ask you again: what sort of advice have you received about the viability of vehicle to grid transmission?

Anne-Marie Trevelyan: This is not happening now. I am sure that Minister Maclean, who as she says is in the weeds of the technology as it

is developing right now, will say that we are looking in the medium to longer term at all the potential fuel-storage solutions that would help us to maximise our efficiency with the energy that we need and how best we make use of it.

Viscount Hanworth: It is still speculative, I understand.

Anne-Marie Trevelyan: It is not speculative, but we do not have those big solutions yet. We are very much in the depths of wanting to think as effectively as we can about how we maximise that, so that we produce as much energy as we need, knowing that we can store it in an efficient and capable way so that we do not find we have to produce that much more, because we do not need it if we use it intelligently. It is the efficiency argument driving right through the system, in a way that it has not been for a very long time.

Viscount Hanworth: We will need a lot of electricity for other proposed industrial applications. Perhaps Rachel Maclean has some comments to add.

Rachel Maclean: Yes, thank you very much, Viscount Hanworth. Minister Trevelyan has set out the main points, but certainly from a vehicle-charging perspective we are paying a lot of attention to the potential of the smart-charging technology applications and building on that with vehicle to grid, which is where we want to get to, in which in effect the vehicles themselves are storing the power when it is not used and that can be used to feed back into the consumer's home or other applications. That is clearly the holy grail, which is ultimately possible, we believe, but work needs to be done before we get to that. At the moment, all the chargers that people have installed in their homes must be smart chargers or we are rolling that out to make sure that they are. We are setting out a pathway for this to happen.

As I am sure Minister Trevelyan does, I talk regularly to the power companies and the DNOs, and we think about and try to work through all the barriers that could stand in the way of having a charging infrastructure available at scale, wherever it is. We are not just talking about the strategic road network but major fleet operators, many of which are making commitments all the time publicly to transition to electric vehicles. All of them will need to have their depots connected. All the electric buses that we are running out across the country will need adequate charging infrastructure. The demand will only increase, which is why it is really important that we have the Office for Zero Emission Vehicles, which sits across both my department and Minister Trevelyan's. We work very closely, in lockstep, to address both the power generation and storage and then ultimately the use of it in the vehicles.

Viscount Hanworth: Do you envisage that a pricing system could be used to influence the demand profile of electric vehicles? If you charge very high prices for electricity, you might be able to influence when these vehicles are charging and when they are delivering to the grid. Is that a possibility that you are envisaging? People have a tendency to use the cars at times that are inappropriate.

Rachel Maclean: Yes. Essentially you are talking about the whole smart-charging idea, which is that consumers can decide when is a good time for them to charge their vehicle and take advantage of lower costs on the grid at that particular time. So, yes, absolutely. That is already happening, but we will see that adopted in a much more wide-spread fashion very quickly. This is more Minister Trevelyan's area, but the power in the system is very well set up to understand these challenges and to invest in the technology and the research that is required to enable all this to happen, because that is absolutely where we need to get to.

Q170 **Lord Kakkar:** I would like to turn to the question of research and innovation, and the landscape here in the United Kingdom, and whether it is the view of the two Ministers that we have the appropriately constructed research and innovation infrastructure to support both the battery and fuel-cell sectors. Maybe Minister Trevelyan would like to start.

Anne-Marie Trevelyan: Thank you. As we have already discussed a little, battery development has obviously been going on for longer. I think there is a very thorough assessment of that, but I think that UKRI has leaned in very hard on this. There are key investments that we are funding through UKRI: the Faraday battery challenge; the Driving the Electric Revolution challenge; the Prospering from the Energy Revolution challenge; the UK Energy Research Centre; and, as I mentioned earlier, the H2FC—hydrogen and fuel-cell—SUPERGEN hub, which is an exciting area.

We have a number of really active and cohering groups bringing together particular university skills so that they are working together as effectively as they can. One of the challenges, which you will highlight, I am sure, was signing up to carbon budget 6 that into law, which I will be doing very shortly. That is a powerful motivator, because the small shift up to 78% by 2035—it was 75% before—means that we pretty much have to decarbonise the power sector by 2035.

We have brought everything forward by 15 years. That is cohering an incredible energy requirement, and a real energy, from across R&D and innovation with businesses. Businesses are leaning in. The historically major oil and gas industries are now looking to be broader energy businesses, and are working together to find solutions and go from R&D to commercialisation and delivery. There is great energy there. Carbon budget 6 has created much greater enthusiasm as well as necessity for us to push that forward. It is very exciting to see.

Lord Kakkar: Could Her Majesty's Government be doing more to facilitate this research and innovation landscape? You speak correctly about all the impressive UKRI initiatives and stimuli for collaboration between the public and private sectors, with a particular focus in the battery area, as has already been identified, but what about further fuel-cell or hydrogen sector research? Could we be doing more?

Anne-Marie Trevelyan: I could not give you a clear answer as to whether we are missing something, or whether there is a scientist who has invented something that we have not found yet. We are harnessing and reaching out to all those who are working in research and development in the sector.

Really importantly, the private-public partnership is genuinely the strongest driver that we have, because businesses have to go net zero. They have to make commitments to their shareholders to meet net zero. That is about putting the energy—if you will pardon the pun—behind it; shareholders pushing their boards to think differently, to go looking for solutions and to test that in a way that, even five years ago, they were not doing, alongside the teams of experts and civil servants in BEIS, DfT and Defra, and the teams in Innovate UK and UKRI, who are all there to support business and work together to make sure that we are cohering all that. One of our strongest drivers is that UK businesses committed, individually and collectively, to go net zero, and to do that they will want to find the best solutions and make sure that they can harness and commercialise them.

To Minister Maclean's point—that, because of the shift, we anticipate that we will probably be looking for four times as much electricity by 2050 as we need now—from my perspective as the Energy Minister, making sure that the power sector, the underlying supply side, is decarbonised and can match the requirements is also about thinking through using smart technology and using it as effectively as we can. The most powerful drivers are business and the consumer.

Lord Kakkar: That is a clear statement. Minister, do you believe that UKRI, as currently organised, is sufficiently well positioned to respond and to provide that enhanced ability, driven by the consumer and by the private sector?

Anne-Marie Trevelyan: UKRI does not sit within my remit particularly, but the Secretary of State has been focused on making sure that it can do exactly as you say. The new team that has come in recently is very focused on exactly that—maximising the reach to make sure that there is a joined-up and impactful support system. Amanda Solloway, who is currently overseas, could give you chapter and verse on the impressive new energy of the team that has come in to help push the agenda forward.

Lord Kakkar: If I may, Minister, I will just pick up on a point that you made earlier about the hydrogen sector. I think you said that it was a fair challenge. How might Her Majesty's Government and your department respond to that challenge with regard to the disparity of attention, let us say, between the battery and hydrogen sectors?

Anne-Marie Trevelyan: I am not sure that there is a disparity of attention. I think that any disparity is partly about time. The battery technology thinkers have been thinking for that much longer, and in greater numbers, about setting the target for zero-emission vehicles into law by 2030, 2035. That has spurred everyone on to think about how to do it and how to continually improve the technology.

Hydrogen is still in the earlier stages of development, both in R&D and business terms. Whether there should be something like the Faraday Institution to oversee all that would come as much from industry and research as it would from BEIS. Hannah Boardman may have a view. She is a deep specialist in this area. You heard from her earlier, I know. Whether that is the right solution at the moment I do not know, but certainly BEIS, with our world-first hydrogen strategy, is setting the pace for how we look at it in the round.

Lord Kakkar: Do you have anything to add, Minister Maclean?

Rachel Maclean: Minister Trevelyan has covered most of it, but I want to add a few points from the transport perspective.

Your original question was about R&D into fuel cells and hydrogen production. The Office for Zero Emissions Vehicles works with BEIS. Our scientists collaborate very closely. We have a number of programmes going on, particularly for heavier vehicles. This year, we have our zero-emission road freight trials, which are technology agnostic, so again I slightly challenge your comment that we do not focus on hydrogen. We do focus on hydrogen. We are technology agnostic; it is just that the market and industry have often responded with batteries and electrification, because that technology works and is available now, whereas hydrogen is a bit further away.

The zero-emission road freight trials are looking at heavy lorries and how we decarbonise them. That is a £20 million programme. We are looking at a very interesting range of technologies, including electric catenary—the overhead lines.

We as government do not really mind how we get to net zero. Clearly there are benefits to all these technologies for industrial agglomeration, the benefits and the jobs—for UK industry—but ultimately we have to get to net zero, so we have to work out the fastest way to get there. These technologies will be competing against each other, and we will learn a lot from how they perform in real-life situations. Those trials will include hydrogen technologies, and we will definitely learn a lot from them.

The Chair: Thank you. I might come back to that question later on, but we now move on. Lord Krebs, you might ask your supplementary question before you go on to your main question.

Q171 **Lord Krebs:** My supplementary question follows on neatly from what Minister Maclean was just saying.

With regard to decarbonisation of the transport sector, does the upcoming strategy, which I think you said would be published shortly, include rail?

Rachel Maclean: Yes. The transport decarbonisation plan includes rail. Every mode of transport is included.

Lord Krebs: Given that a relatively modest proportion of the network is electrified, how do you envisage decarbonising freight and passenger rail?

Rachel Maclean: Rail is a vital part of the transport decarbonisation plan. We will be setting out a lot of detail in the plan. We will be working very closely with Network Rail. The new body, Great British Railways, will have a key role in that. We will be talking about how we ensure that the railway becomes decarbonised. As you will be aware, a number of technologies are suitable for traction decarbonisation. A lot depends on the type of rail—whether it is for freight or passenger traffic—the terrain, and a number of other factors. Hydrogen is an option for some of those, as are battery and dual modes. There are a number of ways to achieve the decarbonisation objective. Network Rail is working through a lot of detail across the network through the traction decarbonisation network strategy, which will underpin what we go on to say in our own TDP about how we see that developing over the next few years until we get to net zero emissions by 2050.

Q172 **Lord Krebs:** Thank you very much. Rather than follow that particular path, I will revert to the question that I am supposed to be asking, which concerns the supply of critical raw materials and minerals, particularly for manufacturing batteries.

The background to my question is that we have heard in evidence that the UK lacks a supply chain for critical minerals. We have also heard that in the European Union there is a CRM list, which indicates materials of high importance, and that we do not have such a list in the UK. We have also heard that Defra published a report on critical raw materials, but many of its recommendations appear not to have been implemented yet.

That leads to my question. When will the UK develop a strategy for critical raw materials and minerals? Perhaps Minister Trevelyan might kick off with that.

Anne-Marie Trevelyan: This is a really important area. From the batteries perspective, cobalt and lithium are essential elements. They are not rare, as such, but the concentrations are only high enough to be economically extracted in certain places in the world. What is very interesting is that there are potential brine extracts in parts of the UK that are lithium rich. A UK start-up called Cornish Lithium is currently exploring deep brine in the south-west. Innovate UK has provided £850,000 of support under the Satellite Applications Catapult for a study, because satellites also use lithium.

There are some new battery technologies that do not use cobalt. The Faraday Institution is looking into them.

Metals such as platinum and rare earths—yttrium, lanthanum and cerium—are crucial to the manufacture of fuel cells. The challenge is about where they are, and other issues.

The issue was highlighted in the integrative review and quite a lot of work is going on under Project Defend, led by the Department for International Trade. I have cohered a cross-Whitehall ministerial group to pull together a great deal of expertise that has not historically been looked at in a single way. That work is ongoing.

I would not like to say that we will publish a strategy yet, because I do not think we have made it that far, but that is very much the direction of travel. This is critically important in a number of areas, but obviously so from my perspective in BEIS and the new technologies. A great deal of work is going on to help support what we want, which, as the integrative review set out, is to have a much stronger supply chain over which we can have control.

Lord Krebs: So just to recap and play back to you, a one-sentence answer to my question—"When will you develop a strategy?"—is, "Not yet".

Anne-Marie Trevelyan: We are working across Whitehall on how best to do that. Whether it is led by BEIS or from elsewhere is one of the questions that we have not yet answered, but without doubt there is a strong positive sense across Whitehall that we will get there. My instinct is that we will end up driving it from the Cabinet Office.

Q173 **Lord Krebs:** Thank you. Under the general heading of how do we source critical raw materials, I have two supplementary questions. Again, I am sorry to come back to you, Minister Trevelyan, but it seems to be your area. I will ask Minister Maclean if she wants to add anything afterwards.

The first question concerns the recycling of batteries and whether we are intending to align our regulations on battery recycling with those in other jurisdictions—for example, the European Union regulations. The second supplementary point concerns competition. We know that China has built very strong, dominant links with the supply chains for some of these critical materials. Will that make it additionally hard for us to elbow our way into these supply chains? So there is one question about recycling and one about international competition, particularly with China.

Anne-Marie Trevelyan: I would not want to try to answer the recycling question, because recycling sits within Defra, but I am very happy to make sure that Defra comes back to the committee with information on where it has got on that one.

The challenge of competition for raw materials and resources is a key issue, which is why it was raised in the integrative review. Thinking about how to make the supply chains more robust and within our own control is very much part of the work we are doing at the moment.

So it is a challenge that has been well identified through the integrative review process and one that we now want to think holistically about. We do not want it necessarily to be about every kind of rare earth metal, but that is something that we want to be more comfortable with. We are also working with businesses that are growing these new technologies, for instance the gigafactories, to understand what their requirements are and what their supply chains look like. This is ongoing work.

I will make sure that the Defra team provides you with more information on recycling.

Lord Krebs: On the processing of raw materials, is your point that we

have strength in that area and that perhaps our focus on the processing stage could be part of cutting a deal with other countries? Is that what you were suggesting?

Anne-Marie Trevelyan: We are in the early stages of thinking about this area, as are many countries, as we move to using raw materials in much greater quantities and with more criticality.

Another issue which a number of businesses are just starting to seriously think about is the recycling of other components, not just the battery, in some of our major renewable infrastructure as it is recycled after 25 years and we go to the next generation of wind turbines or solar panels, for instance. That is very much in the Defra space. An enormous amount of work is being done on recycling, thinking in a much more circular way about our use of all elements but particularly the rare earths, which are expensive and difficult to get hold of. There is an opportunity for us to become experts.

Lord Krebs: Thank you.

Q174 **Baroness Manningham-Buller:** In the course of this inquiry, we have heard quite a lot about the different and additional skills that will be needed across a range functions—supply chains, manufacturing, safety, engineering, and so on.

By the Government's own account in "build back better", there is a persistent skill shortage in the UK. We know about some of the things that the Government are planning to do to address the shortage, but I would like to press both Ministers on their optimism that we can make up this acute skills deficit in time for 2030, because there is obviously pressure.

Could I start with you, Minister Trevelyan? Do you have confidence that we can build those skills? If you could pick out particular ways you think we will do it, I think the committee would like to hear about them.

Anne-Marie Trevelyan: You are absolutely right. Our most important asset in helping us to get to net zero will be our workforce. We need people to have the right skills in the right places to help to deliver the transition to low carbon, from the very highest-end researchers and technical skills right through to the high-street car mechanic and builder who will be delivering different tools to help us. For instance, you will need different skills to service your electric vehicle from those needed to fix an old farm Land Rover, and all the building work that needs to be done to help our homes become more efficient, alongside power generation and engineers to manage the smart grids. We need new skills at every level.

I was just talking to a Defra Minister this morning, and from Defra's perspective we need skills in ecology and the delivery of all the nature-based changes that we are looking for to help to get maximum impact from decarbonisation.

BEIS and DfE have set up the Green Jobs Taskforce, which will deliver its report to us hopefully by the end of June. The taskforce has drawn together businesses, skills providers and unions to help us to develop plans for long-term, good-quality green jobs by 2030. Not only new jobs but a lot of transitioning skills are needed to help to make sure that we get the very best out of everybody's workforce capacity, alongside thinking about how we embed in our current school generation the right encouragement to pick careers in areas where they can be part of the green revolution.

It is wrapped across the piece. Apprenticeships will be incredibly important, as will some of the work coming out of the Department for Work and Pensions, such as the Kickstart work, to help to get people into these new areas. At the end of last year, the Institute for Apprenticeships and Technical Education set up a green apprenticeships advisory panel to help to think about how we can maximise the outputs from the next generation coming into this space.

One of the exciting parts of the net zero challenge is that there are many jobs that young people may not have thought of yet. Young people want to be part of the green revolution; they want to help to decarbonise the world and help us all to live more sustainably. There is a breadth of career options for them that we want to draw out and push forward through the Green Jobs Taskforce to make sure that the next generation is also thinking about decarbonisation and making the right choices early on.

Baroness Manningham-Buller: I accept what you say about young people wanting to help save the planet. What about reskilling the existing workforce? Having a jobs-for-growth strategy is great, or I hope it will be when we see it, but the problem of reskilling has been very persistent in the UK, as your Government happily acknowledge. The best strategies will not address that by themselves. What about reskilling existing workers? Would you like to comment?

Anne-Marie Trevelyan: Yes. Let us look at automotive skills, perhaps. That is probably the most urgent area, because we have a hard cut-off in 2030. There are 149,000 jobs in the automotive sector across the UK and reskilling the current workforce will be critical. We have invested £16 million over three years to next year in the industry-led national manufacturing competitiveness programme. It is open to all automotive suppliers across the UK and is designed to help them to improve their competitiveness, raise workforce capability and improve productivity using a tailored, business improvement plan process. We are engaging closely with the industry to think about where else might be the right place to exactly that sort of joint work.

Baroness Manningham-Buller: Can I check that I have understood you? We have heard about the automotive industry and the £16 million. Are you looking at other industries?

Anne-Marie Trevelyan: Yes. Part of the Green Jobs Taskforce challenge that we set for them was to come back to us and say, for instance, "We will need this, this and this, in this and that area". We are already in the

delivery phase in the automotive area. Part of the taskforce's challenge is to report back to us, highlighting what sort of initiatives they want. The DfE has an emerging skills project for higher technical skills, helping us to develop long-term plans to chart out the skills that we will need. It is very much industry-led and for them to see what is needed and then for us to work together to help find the right carrots and sticks to help them to deliver that.

Baroness Manningham-Buller: Thank you. Does Minister Maclean want to add to what Minister Trevelyan has said?

Rachel Maclean: No, except that it is obviously vital for my field, transport, that we have these new jobs, introductory skills and reskilling. The industry is crying out for them.

I have a personal interest in that my youngest son is studying auto mechanics at my local college. I have seen first-hand how much training he is having on EVs and, at the moment, it is not enough. We need to address that, and Minister Trevelyan is leading on that work.

Baroness Manningham-Buller: If we manage to reskill the existing workforce and develop young people with these skills, will we have enough skilled people, given the substantial deficit in literacy among our school leavers?

Rachel Maclean: I would have to ask Minister Trevelyan to answer that question.

Anne-Marie Trevelyan: It is a really important question. I hope that part of the output of the Green Jobs Taskforce will indeed be that, if industry feels there are gaps that we need to highlight, the Department for Education, which has been working hand in glove with BEIS on this, will be able to hone in on that to find ways to shift the dial on literacy and numeracy.

Speaking as a north-east MP, when you look at the statistics on the energy industries widely, and on the other industries in which delivering net zero has a lot of business opportunity to it, those sectors are very, very male. The lifetime skills guarantee will offer a lot of women who would not previously have gone into those sectors, and whose families have perhaps now grown up, the opportunity to come into the sector and train up in a way that would have seemed impossible before now.

That will enable us to harness a lot of latent talent that does not have the specific skill but which we want to make use of. That, for me, is a really important part—broadening diversity across all sectors that will help us to deliver net zero is important—because why would you not want to be part of that revolution? That has not been seen historically, but with the lifetime skills guarantee and whatever other tools business and government work together to build we will see a much more mixed workforce coming into these sectors.

Baroness Manningham-Buller: This committee definitely looks forward to seeing the specifics of your plan. Thank you very much.

Q175 **Baroness Brown of Cambridge:** May I start by apologising to both Ministers that I was unable to join at the beginning of this session? I am sorry if I go over ground that my colleagues have already touched on.

We have heard a lot about the very large investments that competitor countries such as the USA, Germany, Japan and, of course, China are making. We have heard that the UK is lagging in the battery sector and that we could struggle to build sufficient gigafactory capacity to support EV production.

Minister Trevelyan, can the UK improve its attractiveness for investment sufficiently to challenge the global leaders in either batteries or fuel cells? If you think we can, what are the Government going to do about it to make this happen?

Anne-Marie Trevelyan: As we discussed earlier, the UK has substantial expertise in a number of these areas. We are working internationally and, through things like the Faraday Institution, working very closely with the US and Canada.

Drawing in investment, which is very much Lord Grimstone's area within the BEIS team, is a very active, successful and promising part of these new sectors we are building on. We are setting the pace. Particularly in the industrial decarbonisation strategy, which I published in March, we are setting very, very clear frameworks for businesses to come and invest here. I am hearing weekly, as I talk to stakeholders, both UK-based and more widely, that certainty and that clarity is what is providing the incentives for them to think about that inward investment. We are seeing some really positive activity.

The other thing is that many companies, particularly the energy companies of course, are international companies and they are pitching for project investment to a global board. They—pick a company—are telling me regularly that the UK is giving them a really great reason to invest in the UK. That is with our commitment to offshore wind and all that follows through from that, and there is real excitement about the hydrogen strategy, for instance. That is driving that with those big, global companies.

I am very confident that we are absolutely giving the right base from which business will want to, and can, find great places to invest in the UK.

Baroness Brown of Cambridge: I will be interested to know what the evidence is that this is happening. We saw evidence from Bloomberg studies back in 2019 of over €100 billion of investment in battery supply chains across the EU. In the *FT* yesterday there was an article about Johnson Matthey's investment in Poland and Finland in factories for new cathodes for batteries for automotive. What is the evidence that we are also seeing this kind of focus on the UK in this area?

Anne-Marie Trevelyan: If I may, I will ask the team to pull that together, because it sits in Lord Grimstone's area and I do not have that

data to hand. I will make sure that we write to the committee and give you a broader picture.

Q176 **Baroness Brown of Cambridge:** Thank you very much. That will be very helpful to our inquiry.

Also, in the past, we have rather undermined investors' confidence by not going ahead with the early CCS competitions and the changes to the feed-in tariffs, and most recently by the withdrawal of the green homes grant. Are we going to be able to give investors confidence that we will be consistent about our policy and support going forward?

Anne-Marie Trevelyan: That is a really important point. The Treasury will publish its net zero review, I think before the summer recess. That is the plan, but you would have to check with them; I would never want to speak for the Treasury. That long-term picture is one that the Treasury is very determined to set out, exactly to help to give real clarity and investment reassurance to those who are looking to make those investments.

On the domestic front, we are continuing to move forward across every area. Obviously, there is a spending review in the autumn, which we hope will be able to be multiyear after last year's very difficult year financially for the Treasury and therefore that there will be a chance to think long term on how we help invest so that businesses can skill up and help to progress the net zero challenge.

Baroness Brown of Cambridge: We heard yesterday from investors. One of our US witnesses said that he thought the UK was behind in batteries at the moment, but that perhaps we should not be worried about that because a lot more innovation was needed for the future. If we had a big push on investment in the research base now, we could be well positioned for the longer term. Are we going to be able to see that? Will there be enough funding for UKRI in order for us to do some catching up?

Anne-Marie Trevelyan: Yes. As Minister Maclean mentioned earlier, there is a great deal of investment and real focus in that R&D, because the technology is moving at pace and we want to make sure that we get that. The public-private relationship there is really powerful, because businesses want to be on the front line and get the benefit for their shareholders as well as to be able to deliver the latest technology. So we are working hand in hand with them across a number of sectors, from automotive and battery technology right through to hydrogen and those long-term fuel-storage potentials harnessing the green energy that we are building at an incredible pace.

Baroness Brown of Cambridge: So we can expect a good outcome for UKRI from the spending review.

Anne-Marie Trevelyan: If only I could answer that question, Baroness Brown. I would love to say yes, but I would not dream of presuming anything, I am afraid.

Baroness Brown of Cambridge: Thank you very much.

Q177 **The Chair:** Minister Maclean, I think you missed answering the question about HGVs and the use of diesel. Do you think banning diesel for HGVs may spur development in fuel cells for decarbonising HGVs?

Rachel Maclean: Yes. We are not banning anything. I want to be clear on that. We are ending the sale of new petrol and diesel engines in cars by 2030. We are currently consulting on what we do with HGVs, because you are right to say that obviously we need to have a similar approach to them.

If I may add something, which is relevant to Baroness Brown's last point about investment in this country, quite often stakeholders will come up with figures of various investments which they claim other countries are ahead of us on. All I will say is that it is always a fair challenge, but often they are counting completely different things.

We know that in the UK we have a much more ambitious set of policy levers, and those are the things that drive the private sector investment that Minister Trevelyan was talking about. I will point to the 2030 phase-out date. We are the only country to have such an ambitious phase-out date. We are also the only country that is publishing a plan on how we will decarbonise our whole transport system, and how we remove vehicles from our air, seas and skies that are polluting and damaging our planet.

I work with International Transport Ministers through a lot of the COP forums. We try to encourage them to be more ambitious, because the European Union does not have a phase-out date for cars, vans and HGVs, for example, and nor do many other countries—or they have it, but it is behind ours and is not fast enough. We know that we need to get them to go faster and it has to be international.

Industry will then respond to those signals, because those are signals that are locked down and there is that certainty. It gives them that investment horizon they can plan to. Often those are not captured in official government figures, but they are vast sums of investment that we are seeing from the industry. This is particularly the case in the automotive industry; you will have seen the number of new models that are now coming forward from automakers that are introducing new vehicles that are electric and the prices are dropping. We are seeing whole businesses—I think Fiat was the latest one—announce that all their models will be going electric.

This is how we achieve this progress. The Government have a huge role to play, but those dates, those policy frameworks and those signals to the market are critical to this.

The Chair: Thank you very much. I was going to say that I would give you the last word, but you already got the last word in. Minister Trevelyan, do you have a last word?

Anne-Marie Trevelyan: Thank you so much, Lord Patel. I am so pleased that you are doing this inquiry. It will be really, really helpful for us. We

look forward very much to seeing what your perspective, looking across the piece, will bring out, so thank you for the work that you are doing on this.

We have set ourselves an extraordinary challenge. I am working quite a lot of the time on COP with CPD and talking internationally. The world is really impressed that we are taking on this challenge and driving it so hard and so fast, and we are seeing industry taking up the challenge, wanting to meet the challenge and to be at the front end of the success story, knowing that the whole planet has to do this. I am really proud that we, as a country, are pushing that forward.

It is about working together. It is as much about carrot as stick for me to make sure that consumers can engage and be part of this revolution and that together we really can deliver the initial 78% decarbonisation target by 2035. In doing that, with all the technology that we see coming out of the UK, we also help many other countries—my particular interest is developing countries—to be able to meet some of those challenges too and to see the benefits of clean growth for their economies. I am really excited that the UK is leading in so many areas.

It is not easy; some of the challenges are technically very real. But everyone in every industry tells me that they are more enthused than they ever thought they would be if you had asked them even two or three years ago. I find that very encouraging. We will make sure that we set the right frameworks and, with the right regulation, help to support them so they can grow wings and fly, if that is the right terminology.

The Chair: Thank you very much. I hope our committee's report will help you to be even more impressive. Thank you, Minister Trevelyan and Minister Maclean, most enormously for joining us today. It has been a most helpful session. Thank you for making time to help us. Thank you very much. Bye, bye and good luck with your work.