HOUSE OF COMMONS

Transport Committee

Oral evidence: Fuelling the future: motive power and connectivity, HC 973

Wednesday 16 March 2022

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Watch the meeting

Members present: Huw Merriman (Chair); Mr Ben Bradshaw; Ruth Cadbury; Simon Jupp; Karl McCartney; Grahame Morris; Gavin Newlands; and Greg Smith.

Questions 225 to 309

Witnesses

I: Trudy Harrison MP, Parliamentary Under-Secretary of State, Department for Transport; and Caroline Low CBE, Director, Energy, Technology and Innovation, Department for Transport.

Written evidence from witnesses:

– Department for Transport

– Correspondence from Rob Bishton, Group Director for Safety and Airspace Regulation, UK Civil Aviation Authority, dated 8 March 2022

Examination of witnesses

Witnesses: Trudy Harrison and Caroline Low.

Q225 **Chair:** This is the Transport Select Committee's final evidence session in our inquiry "Fuelling the future: motive power and connectivity". We have the Minister with us today. Could I ask her to introduce herself for the record?

Trudy Harrison: Thank you, Chair. My name is Trudy Harrison. I am the Minister for Transport with particular responsibility for decarbonisation and the future of transport.

Caroline Low: I am Caroline Low, the director for transport decarbonisation at the Department for Transport.

Q226 **Chair:** Minister and Caroline, thank you very much. I was going to call you the ministerial team, but you are with your official, so I would have got that wrong. Welcome, and thank you both for being with us.

In this inquiry we have been looking at the alternatives that are available if we are to hit our net zero commitments, conscious, as we always are as a Committee, that transport has the largest carbon footprint of all sectors. We are particularly interested as to what all the ranges of alternatives are to ensure that the right policies are being pursued.

We will go all the way through the sectors—maritime, aviation, road and rail—but, as a general opening, the Government have stated that they are technology agnostic when it comes to delivering net zero for transport. How can we achieve net zero emissions while being agnostic? Isn't it time now to go for certain winners as options?

Trudy Harrison: To set the scene, in 2019 the Government committed to net zero by 2050. In 2020, the Prime Minister set out his 10-point plan for a green industrial revolution. Building on that, in July 2021 the transport decarbonisation plan was published by the Department.

The reason we have prioritised cars and vans is that 67% of emissions come from those vehicles. It was both a need to achieve net zero and a recognition, from speaking with manufacturers, that there was a way to do it. The way that industry recommended we do it, and the decision that we took to phase out the sale of new petrol and diesel cars in 2030, was that approach. That is not as simple with the bigger vehicles. With heavy goods vehicles, with maritime, with aviation and with rail, we know that it is more of a portfolio of options, depending on the weight, the journey type and the topography.

I represent Copeland in the Lake District. The way that we would power rail, for example, is very different from what you might do in a flatter, urban area. The decision to be agnostic is, quite frankly, because we do not yet know what the solutions are, which is why we have invested heavily in research and development and in trials. We also think it is really important, particularly when bringing the public along with us, to

be able to refer to a particular area where something has worked well. There are some fantastic examples which I am sure we will get into the detail of.

That is why, for cars and vans, the priority at the moment is electrification. For heavy goods vehicles, it will be a plethora of options, certainly looking at hydrogen, electrification and catenary wires, similar to rail. For maritime, it is particularly complex, not least because of the international nature of maritime. For aviation, we are already working on drop-in fuels. We have a commitment to 10% of sustainable aviation fuel by 2030.

It is looking at the type of fuel and the type of feedstock. There are multiple things that need to be considered—sustainability, availability and security of supply of the feedstock, and the actual processing ability. This country is rich in chemical processing, particularly in areas where levelling-up is a priority as well. It is also the benefits in apprenticeships and training, and the local economy. It is then thinking about the distribution and the infrastructure that would be required at airports or wherever.

It is complicated. It is not easy, but we are world-leading. That became obvious to me when I was at COP26, speaking on the stage in Glasgow and speaking with other world leaders. We are absolutely world-leading. We are leading the world in this, which is why the pressure is on to be successful.

Q227 **Chair:** Do you believe we can be successful, though? As we have found, and heard, in this inquiry, there are certain sectors—you touched on maritime and rail—where the ships that are being made now are going to last up to 2050, and the same for the rolling stock on rail. Unless the decision is made now as to what that decarbonised power is going to be, how will it be decarbonised by 2050? Those vessels and trains are going to be in operation at that time.

Trudy Harrison: The short answer is that I absolutely believe we can be successful, but it is not just for Government. Industry plays a massive part, and has done already. Just recently, we have committed a further £206 million specifically on maritime.

It is fair to say that we are looking at drop-in fuels on maritime. The commitment that new vessels from 2025 will have that capability is the important part. We already know that about 6% of road fuel is made up of biofuels, which are in effect drop-in fuels. Yes, is my answer. Is it easy? Absolutely not. Does it require determination and ambition? Definitely. Do we have it within our country to do this? We are pioneers. We are built on risk-taking, smart machine-making engineers. From the north of England, I can safely say that I think we have that capability in our country.

Q228 **Chair:** A final question from me before I hand over to Karl and then to

Greg. When the Government say that they are technology agnostic, is that really just in the sectors where we do not yet know what the right or best option will be? If you look, for example, at roads and electric vehicles, that is where the Government are investing £950 million in electric charging points and they are deregulating in that area. That seems to be one particular market where the Government have decided that, "No, when it comes to cars the future is electric, so we are not technology agnostic on that particular mode." Is that a fair way of summarising it?

Trudy Harrison: Our directive was to be zero emission at the tailpipe by 2035. Yes, we have phased out the sale of petrol and diesel cars by 2030. Hydrogen could still be an option, but there are about 14 public hydrogen fuelling stations across the country versus about 29,500 public electric charging points, and, of those, over 5,000 are rapid; plus all the charge points that people have on their driveways, it will be in excess of 350,000.

The infrastructure has been installed right across the country for electric vehicles but, more importantly, manufacturers have stepped up. We now have in excess of 140 different makes and models of vehicles with a plug; one in six now sold has a plug. I think it was 11.6% of new vehicles in 2021, 20% in January and 17% in February; all those new cars have a plug attached.

Manufacturers have stepped up. We are rolling out the infrastructure. Are we there yet? Absolutely not. We probably need about 10 times the amount, which is why we are spending so much on the infrastructure. We will shortly be bringing out our electric vehicle infrastructure strategy.

There may be a place for hydrogen, but we have to bear in mind the efficiency as well. There are a number of things to think about. First, the efficiency of an EV is about 70% compared with a fuel cell at about 30% and direct combustion at about 20%. You also have to bear in mind where else we are going to use hydrogen. It might be in heating for homes. It will very likely be in large vehicles, particularly teens of tonnes, heavy goods vehicles. It is likely to be in rail. It may be in shipping.

We have a commitment in the 10-point plan for a five gigawatt production capacity of hydrogen, but we are way off being able to do that at the moment. It is also important that that hydrogen is low carbon. The hydrogen strategy set out by my colleagues in BEIS makes it clear that the sustainability and supply of hydrogen must be low carbon. You are looking at renewables. You are looking at the potential for nuclear. We are certainly not looking at steam methane reformation.

Q229 **Chair:** Caroline, is there anything you want to add to any of that before I hand over to Karl?

Caroline Low: A couple of small points. The regulation is technology neutral. The decision to phase out the sale of combustion engines in the

passenger car sector does not preclude the use of hydrogen, but, as you said, where we have seen that industry has coalesced around one solution, that is where it is the most value for money for Government to put in support for the infrastructure. I think we will see that happening in the other sectors. At the moment, the absolute priority in maritime and aviation is to fund the research and development in order to understand which are going to be the most efficient technologies, and what infrastructure is needed to support those technologies, which is where it is likely we will then have a significant role to support that infrastructure.

The other point that has been touched on is that for those technologies where assets have a very long life, we have to think about this as a transition rather than a switch, and make sure that we really understand how fuels—the main subject of this inquiry—can play a role there.

Chair: Thank you both for the opener. I am going to hand over to Karl, and then we will move to Greg.

Q230 **Karl McCartney:** First of all, Minister, there is lots that I could ask you, but I am going to try to keep it short and sweet, regarding some of the stats you have used. We have had previous Ministers from the Department who have made various claims which we have examined and looked for further information on. You particularly said that 67% of pollution is from cars and vehicles, which flies in the face of the figures that we have had before of maybe 12.5% to 16.5%, depending on what road vehicles we are talking about, compared to the 50% of pollution in this country coming from domestic gas boilers.

Where does that 67% figure come from? Is it carbon? Is it nitrous oxide? Is it pollution in general? How does that compare to maritime or aviation? Personally, I would say that from my experience vehicles on our roads in this country produce far less pollution than those two sectors.

Trudy Harrison: The 67% is cars and taxis. I suppose we group them together as greenhouse gas emissions.

Q231 **Karl McCartney:** Pollution in general.

Trudy Harrison: It is helpful to make that clarification.

Caroline Low: Can I check? I think you may be at slight cross-purposes. You are talking about the proportion of transport emissions, Minister, whereas I think Mr McCartney may be talking about the proportion of emissions in the whole economy.

Q232 **Karl McCartney:** I am trying to figure out what the actual percentage of the pollution in this country, if it is generic general pollution, is caused by the 35 million business or personal/private drivers on our roads compared to the other forms or creators of pollution, whether that be domestic or other forms of heating, aviation as a sector or maritime as a sector. I do not think the 67% stands up in that respect. You will tell me where that 67% comes from, I hope. If you cannot now, please do later.

I am just trying to drill down to find out what that figure is and where it comes from.

Trudy Harrison: On the transport statistics, the transport decarbonisation plan sets out that cars and taxis are responsible for 67.7% of UK domestic emissions. Heavy goods vehicles are responsible—

Q233 **Karl McCartney:** Of transport emissions?

Trudy Harrison: Of transport, yes. In terms of what other Departments have calculated, I will get back to you on that more general figure. On transport, I am more than happy to reaffirm—

Q234 **Karl McCartney:** That is on-land transport, I am presuming. That is not including aviation and maritime.

Trudy Harrison: No, no. Rail is about 2%. I am going to make sure that I give you the exact figures, Karl. Heavy goods vehicles, 19.5%; light duty vehicles, 19.2%; domestic shipping is just 6.1%; buses and coaches, 3.1%; and rail just 1.7%. Domestic aviation is 1.4%. Motorcycles and mopeds are 0.5%, a particularly efficient way to get about. Other fuel is 0.7%. Other transport emissions are 2.4%. That is things like plant—JCB. Other manufacturers are available; it is non-road-going transport, if I can say that.

Hopefully, that sets out the emissions as we understand them within transport. In terms of emissions from heat and other forms of energy—steel, cement works, vitrification, glass plants, and so on—I am very happy to write to the Committee after liaising with other Government Departments, if that is okay.

Q235 **Karl McCartney:** The point I am trying to get to is that on vehicles that people use, as a proportion of pollution in this country—from the questions and from the Chair—the Department or the Government over the past couple of decades have gone for the easy option, which is picking on vehicles on roads when, actually, a lot more pollution is created by a lot more other factors out there.

Trudy Harrison: While electrification of the transport network—I am talking about cars—is a worthwhile thing to do because of tailpipe and exhaust emissions, it is also a good thing to do for other reasons. Recent surveys have said that just 1% of those who have transitioned to an electric car would go back to petrol or diesel. We know from the figures that there is a real appetite to purchase electric vehicles.

My other responsibility is the future of transport, where we are thinking about the legislation required for self-driving vehicles and the technological improvements in vehicles now that come with electric vehicles and that kind of technological advance. I was recently at Oxbotica where I learnt that a regular Mondeo could be transformed to a self-driving vehicle within an hour, with their set-up in the boot and the sensor system on the roof rack. I thought that was pretty incredible.

It is not just decarbonisation. It is also about the opportunity for the UK to make the most of the manufacturing capability that we have in this country. It is also about the experience for the driver. It is about safety. It is thinking about the future of transport and recognising that over 80% of collisions involve an element of human error. It really is a huge opportunity to make vehicles safer as well. It is not just the decarbonisation. I do not know if you have ever driven an electric vehicle. I do not own one, but my next car will be a zero emission vehicle. I have had the pleasure of test driving a number now, and they are very impressive, particularly on acceleration.

Q236 **Karl McCartney:** I completely understand the euphoria in your Department for electric vehicles. Some of us do not hold the same euphoria at all. I point out that we have heard the stats from you. One in six of new vehicles has some form of plug, but it does not mean that they are all completely electrical. In fact, quite a lot of those are fleet purchases rather than private purchases. I gently point out that five out of six new vehicles purchased, therefore, are still ICE vehicles.

Trudy Harrison: Indeed.

Karl McCartney: On that point I will hand over to the Chair.

Chair: Greg Smith.

Q237 **Greg Smith:** Good morning, Minister. I look forward, after one of your previous answers, to seeing Karl on his moped shortly. Can we focus a little bit on whose responsibility it really is to decarbonise the transport sector? Rather than specific modes, this is more of an abstract point at the start of this session.

You said in a previous answer to the Chair that industry has stepped up. You said in an answer to Karl just now that there is an appetite among the public for zero emission vehicles. Is it the Government's responsibility, or is it actually something that will happen organically by consumer demand and the private sector meeting that consumer demand?

Trudy Harrison: It is clearly both. The Government have a significant part to play, but we cannot do it without industry. More importantly, we cannot do it without the public agreeing that the decarbonisation of transport, particularly the electrification aspect of transport, is something they want to be part of. Leading up to COP26, we saw the appetite of the public to care for the planet, and then the decision by manufacturers to step up and create these vehicles, and to invest heavily in this country's transition from fossil fuel vehicles to electrification. It is definitely both.

Would the acceleration of manufacturers producing electric vehicles have happened without the Government's pretty brave decision to phase out the sale of petrol and diesel cars in 2030? I doubt it. I think it is the job of Government to set the tone, to set the vision and to set the ambition, but to do so in consultation with industry.

Our most significant partners are local authorities, which is why we are really ramping up the support that we are going to be giving local authorities, developing a toolkit and ensuring that they have funding. It is ensuring that our local councils can also ensure that there is an infrastructure that is fit for purpose and fit for this transition.

It is not the job of Government in isolation. It is an incredibly holistic revolution that is happening in transport. It needs to work for everyone everywhere.

Q238 **Greg Smith:** That is helpful. In light of the inquiry we are running, where we are looking at many different potential decarbonised fuels that can power the transport network—I presume we are coming from the same place in terms of the fact that there will still be cars on the road, certainly in a constituency like mine and a constituency like yours, if I may say so—

Trudy Harrison: Yes.

Q239 **Greg Smith:** The car is essential to people as much as trains, aviation, and so on. If we are coming from that point, yes, the Government took, in your own words, a brave decision to stop the sale of new petrol and diesel from 2030, but have the Government, by putting so much taxpayer subsidy into electric vehicle charging points and focusing so much on electric vehicles—to the Chair's earlier question about being actually technology agnostic—bucked the market a little bit in terms of just that, rather than allowing a market to develop across the piece, be it hydrogen combustion or drop-in fuels?

The net result at the moment of going down the EV route seems to have been that all ICE development has been completely dropped by every manufacturer, when it is possible that drop-in fuels for vehicles will come along that do not put anything nasty out of the tailpipe, and we will have lost the development that would have gone into ICEs.

Is it the job of Government simply to set the framework? In order to be technology agnostic, should the Government step back a little bit from choosing or subsidising particular routes?

Trudy Harrison: I am going to bring in Caroline, but first I will explain that all of those charge points have not been funded entirely by Government; absolutely far from it. The private sector has really stepped up. Supermarkets, businesses, fuel companies and new companies, really excitingly, have stepped up to fund much of the infrastructure and investment. The Government have set the tone and set the ambition.

In terms of vehicle development and the combustion engine, for aviation I think the Airbus A320neo is now 20% more efficient than it was. We are still absolutely investing in the technological advances in the engines of today. With cars, because there is the alternative of electric motors and because of the efficiency of electric motors and the other added benefits of acceleration, drive quality and self-driving vehicle potential, they all

combine to make that more sensible. Certainly, in maritime and aviation those technological advances, as Caroline set out, are also incredibly important.

Q240 **Greg Smith:** I would like to hear what you have to say, Caroline, but can you perhaps come back on this as well, Minister? Looking through the lens of that last question, is there a risk that we are today, in March 2022, baking in the technologies that are available in March 2022 when there are potentially technologies in development that can answer some of these questions? They are not polished yet and not necessarily commercially viable yet, but you can easily see a path to them being commercially viable in two, three or 10 years, but by that point we will have baked in what was available today or yesterday.

Trudy Harrison: Caroline can finish off, but I think all of the work and investment that we are putting into research and development of this is incredibly vital. T-TRIG is important to touch on as well.

One of the criticisms is that we have not backed a winner. The reason for that is the portfolio approach that we have, to ensure that we do not have that VHS/Betamax moment.

Caroline Low: To talk about e-fuels specifically, I think they will have a niche role in roads. You have spoken to representatives from the classic car industry. There is no suggestion that cars on the road today will not continue to be on the road. There will be a small role for e-fuels, but the industry has spoken rather than Government in terms of where it chooses to put its investment. To me, it seems a bit like the flatscreen TV change. This is what industry and consumers have concluded.

One of the big reasons for backing that comes back to the efficiency in how we use the electricity that is going to sit behind all the future fuels. Putting the electricity directly into the car, rather than turning it into hydrogen and then turning it into a fuel, is about three or more times more efficient and is therefore always going to be more value for money for the consumer.

Trudy Harrison: I stress that combustion engines in classic cars and cherished motors will continue. We are committed to ensuring that the E5 petrol is available for those vehicles. I particularly value the heritage of the motor industry, particularly the British motor industry. I want to make that absolutely clear. I love cars and I love driving. I am sure that I will be driving until my very last days, as long as it is safe to do so. Ensuring that people can continue to drive those cherished vehicles, in particular, is very important.

Q241 **Karl McCartney:** I want to come back to Caroline. You talked about e-fuel and said it was a niche potential. I would like to point out that my constituents will continue to drive internal combustion engine vehicles well past 2030. At this point in time, a new car for them is the equivalent of an eight to 10-year old Mondeo.

I do not know whether the Department has done any research—maybe you can tell us—about what you think the second-hand ICE vehicle market is going to do as we approach 2030. I do not think it is going to become cheaper. I believe that the decisions the Government have made have pushed people down the electric vehicle route. You can say that you can use renewables, but electricity has to be generated from somewhere, and there is an economic and an environmental cost for that. Yes, in the UK we have gone down that route because the Government have made the car companies go down that route, but it is not elsewhere in the world. Look at what Porsche are doing. Look at what other European states are doing. It is certainly not what Japan or America are doing. They are certainly not going down the same route that we are.

Caroline Low: You are quite right to pick me up on the timing. I was talking really about 2050 with niche vehicles and certainly not 2030, as you say. As we all know, cars are in the market for a long time. Certainly I, and most of my team, are not out there buying new cars. We are very much dealing in the second-hand market.

At the moment, the market is unusual anyway because of all the supply issues that we have seen from Covid, and it is very hard to get hold of an electric car in the second-hand market. We will see that change over the next few months as the cars that were first bought by the fleets you were talking about start to come through into the second-hand market. Some of the work we are doing is thinking about how we can support buyers in that market to understand the characteristics of the vehicle they are buying.

Q242 **Karl McCartney:** I understand that, but I again gently point out that, yes, battery technology is going to advance and get better, but once you get to eight years, if you are looking to replace all the batteries in a vehicle, you are going to be spending getting on for £10,000, I would have thought. Not many people who are looking to buy a second-hand vehicle will want to spend that on replacing the batteries. We have some way to go.

Trudy Harrison: It is probably worth explaining the work that we are doing with Faraday. The price of a battery has reduced by a tenth since 2010. Recycling batteries is going to be incredibly important. We already know about the challenges with nickel, for example. That is a real priority. The sustainability of batteries and indeed all components for electric vehicles is important. Is it worth explaining what we are doing on the research and development of battery technology, particularly the recycling and Faraday projects?

Caroline Low: It might be worth—

Q243 **Karl McCartney:** If you want to, you can send us some information about that. I am conscious that lots of my colleagues have questions at this point in time. It sounds very interesting, and I think we would like to see it. If you could send us that at some future date, ASAP, that would be

fine.

Trudy Harrison: Yes, we certainly can.

Chair: Super. Thank you very much. Before we move on to the individual sectors, we want to look at a couple of the Government schemes that are aimed at encouraging the uptake of renewable fuels and reducing emissions, in the form of the renewable transport fuel obligation and the UK emissions trading scheme. We will start with Grahame Morris.

Q244 **Grahame Morris:** Thanks, Chair. Good morning, Minister and Caroline. Would you start by explaining the difference between the two schemes? How does the renewable transport fuel obligation differ from the UK emissions trading scheme?

Trudy Harrison: Certainly. The renewable transport fuel obligation—RTFO—has been in place for about 14 years. I think it was first brought about in 2008. The clue is in the name. It is exactly that: an obligation. It focuses on an obligation with fuel producers to produce a proportion of their fuel in a renewable way, typically using a raft of different feedstocks.

The emissions trading scheme is only relevant to aviation within transport, whereas the RTFO is far broader than that. I will let Caroline explain the difference in policy terms and how it fits into the wider arena of how we are going to ensure that fuels of the future are low carbon, as well as some of the consultations and timelines that we have for potential changes that we are looking to make, particularly to the RTFO.

Caroline Low: Both these schemes are aimed at reducing carbon. They are both market-based measures. They allow trading so that the economy can work out the most efficient place to make the carbon savings. I guess the way I think of it—I hope this analogy works for you—is that the RTFO is a bit like switching from beer to shandy. We put more renewable fuel in the overall fuel. The ETS is a bit more like capping your units at a certain level.

They can work in parallel. At the moment, the ETS, as the Minister said, only applies to domestic aviation. We do not have plans to extend it to the rest of the transport sector, where the RTFO is doing a very good job of reducing carbon emissions in transport fuel. We always keep these schemes under consideration and, indeed, look at them internationally, particularly in maritime and aviation.

Q245 **Grahame Morris:** That is a very good analogy. I have made a note of it. It is very helpful. In terms of the mechanisms and the levers that Government have to achieve their ends in reducing carbon emissions, how does the RTFO—the renewable transport fuel obligation—interact with carbon pricing in other sectors? You mentioned that the ETS is just in domestic aviation. Could you give us an overview of how those levers interact with other sectors?

Caroline Low: You mean outside transport?

Q246 **Grahame Morris:** No, within transport.

Caroline Low: The overlap in aviation. At the moment, as you know and the reason we are having this inquiry, there are very small volumes of renewable fuel supplied for aviation. We are talking about really small amounts in terms of the overlap. What we have done is to be very careful to align the detailed sustainability criteria that apply to the RTFO to the ETS, to make sure there is no mismatch in the fuels that qualify under those two schemes. We will need to continue to monitor that as we develop both schemes.

Q247 **Grahame Morris:** Looking beyond transport into other sectors—the emissions trading and so on—does this fit in with that overall strategy?

Caroline Low: We always keep under review market-based measures to reduce carbon. We will probably come on to talk in aviation about some of the specific measures we are looking at there, such as the SAF mandate and price support measures. There is a balance between economy-wide measures, which can be very effective in finding the cheapest place to remove carbon in the economy, and more pointed measures—particularly where we are thinking about the industrial opportunity and wanting to drive development in a particular sector in this country to make sure that we capture the jobs and the technical know-how.

Q248 **Grahame Morris:** We had implemented emissions trading previously, hadn't we, in the broader economy? There was a marketised scheme to exchange credits and so on. I am not quite sure how successful it was. I am interested to know whether we are learning from those past endeavours and whether we are modifying those schemes to try to achieve the ends in zero emissions.

Caroline Low: We are constantly modifying these schemes. We will probably talk about some of the amendments that have come through the RTFO in recent years in response to a very lively, ongoing debate with the sector about what will work best to incentivise the outcomes that we all want to see.

Q249 **Grahame Morris:** Minister, finally, how does the RTFO support the Government's objective of achieving net zero emissions by 2050? Earlier, you mentioned the maritime sector. We took evidence from a panel that included some witnesses from that sector. Their progress is terribly slow for a number of reasons. Is the RTFO going to assist in achieving the Government's objective by 2050?

Trudy Harrison: At the moment, the make-up is something in the order of 93% of transport fuel being from fossil fuel; 1% from electric; and about 6% from renewable fuels. Does that add up? Yes, it does: 93, 6 and 1. It is a small proportion of the overall fossil fuel usage. In aviation,

I think we get through 12 million tonnes of kerosene in this country. That is about a third of all fuels, to give you some idea.

It is worth paying some respect to diesel. For all its faults, it is an incredibly efficient fuel. Oil-derived fuels, whether petrol, kerosene, diesel or propane, are incredibly powerful. That is the extent of the problem we have to try to solve. With maritime, you have the added complications of its international nature. There are the green shipping corridors that we committed to at COP26. With about 20 other countries, we committed to an ambition of six green shipping corridors by 2030. We do not have them yet. They are in discussion with those other countries.

The RTFO and other forthcoming schemes that we are considering at the moment will all contribute towards that increased supply of fuels. The reason why the RTFO is so complicated is that it is important to be truly sustainable and to look at where feedstocks are coming from. At the moment, a lot of foreign imports are required for the ingredients that go into those biofuels. We have to look at the consequences that that brings for other countries, which is why the paper trail, the accountability and traceability of fuels is vital.

Q250 **Grahame Morris:** Because in our part of the country the climate is ideally suited to growing oilseed rape, I think biofuels—biodiesel in particular—have a lot to endear them, even on a transitional basis, to the maritime sector. You would be talking about fairly large volumes being required, and it could create jobs on Teesside and at Ellesmere Port. It would give a sustainable income to farmers. I think it needs further investigation as a short-term alternative.

Trudy Harrison: Grahame, we are absolutely doing that. In Teesside, the north-east has such a wealth of experience in engineering. My own dad worked at ICI Wilton. I had the pleasure of visiting Nova Pangaea, one of eight companies participating in our Green Fuels, Green Skies programme, which is a £15 million programme to develop a commercial route for aviation fuel.

The Ensus company is also on that site developing biofuels for the transport sector. Ethanol now contributes 10% of the mix in petrol as well. Your area, whether it is renewables or chemical processing, is absolutely going to take advantage of the decarbonisation journey.

Grahame Morris: You have to drive that, Minister. You have to create the incentives.

Q251 **Chair:** Thank you. Before I hand over to Ruth, can I ask about the UK emissions trading scheme compared with the EU predecessor scheme? I note that the UK scheme is more ambitious, with a 5% lower cap than would have been the case had we remained inside the EU scheme. No doubt that is viewed as a positive.

We took evidence from Loganair; we have also been doing an inquiry into regional aviation and the challenges there. Loganair stated that the

"shortcomings" of the UK's emissions trading scheme could threaten the UK's regional connectivity: "The Government has ignored sound advice from sectoral experts…of the limited number of carbon permits released for auction, many have been secured…by large emitters for use in future years, leaving insufficient permits available to meet even the reduced market needs for current-day use."

Caroline, you said that you always keep these matters under review. Are you looking to review this, so that the likes of Loganair can continue their day-to-day operations? They are clearly struggling under this current challenge.

Caroline Low: I was not aware of the Loganair criticism, but I will take that away and check with aviation colleagues as to what consideration is being given.

Trudy Harrison: In other meetings that I have been involved with, with investors for example in the aviation sector, what they have really called for is clarity. The SAF mandate is something that has been called for to provide a level of certainty that investors can get behind, and industry can benefit from as well.

Q252 **Chair:** I suppose it is an example of the future, if SAF takes off and if there is a SAF trading scheme, which we will come on to. But that is for the future. What Loganair are looking at is the here and now. They are struggling to get the permits to continue to operate on a daily basis because they are being swallowed up by the big beasts. Is that the type of thing you are going to have to keep under review?

Caroline Low: We are always keeping the practical operation of the schemes under review, whether they are meeting their objectives and the practical implementation on the ground, whether the carbon-free alternatives are there to provide the permits and the price that those permits are trading at, so that we understand the impacts on the businesses subject to those caps. I am afraid that I do not know the specifics of the Loganair issue.

Chair: I would be grateful if you could write and perhaps consider whether there either needs to be some review to stop the bigger entities swallowing them up for the future, or actually releasing more. It would be helpful to get your thoughts on that.

Ruth, my apologies. I come back to you.

Q253 **Ruth Cadbury:** No problem. Thank you.

Minister, in response to one of my colleagues on a question about the role of the private sector versus Government, you said quite rightly that the Government set the tone and the ambition. Most of our questions are about how the transition is enabled in order for the private sector to actually deliver.

My question is about renewable electricity. Electromobility UK told us that the renewable transport fuel obligation—RTFO—"only supports biofuels,

and more recently hydrogen, but renewable electricity that goes into cars through chargepoints is not supported and you cannot earn credits." Minister, why isn't renewable electricity included in the RTFO?

Trudy Harrison: We are looking at that, I am pleased to say. I also think it is important to understand the consequences of taking electricity off the grid. We have talked about how efficient electricity is when it is directly going into a vehicle, powering the drivetrain, which is more efficient than using the electricity to power an electrolyser to split the water, to create the hydrogen, to go into a fuel cell or for direct combustion. The efficiencies are pretty clear to understand.

We have to bear the consequences in mind. We are also looking at alternative ways. It is important to talk about the work that we do with BEIS. We are focused on transport, but kerosene is not just used in aviation. It is used in other forms where energy is required. It is the same for diesel. It is important to work cross-departmentally with BEIS on this in deciding where the support should come from, ensuring that we prioritise electricity but that we also understand the amounts of alternative fuels that will be required in the coming decades for vehicles that cannot be electrified.

Q254 **Ruth Cadbury:** Thank you. Sticking with the RTFO, the Government have pledged to extend the RTFO to support renewable fuels of non-biological origin used in shipping. What steps are the Government taking to address the challenges that the maritime sector is experiencing with adopting alternative fuels of biological origin?

Trudy Harrison: Just recently, we have committed, I think, £206 million for the UK shipping clearing house—

Caroline Low: Is the question specifically about fuels from crops and waste as opposed to hydrogen and ammonia? On advice from the Committee for Climate Change, and following a consultation, we decided not to include those in the RTFO for maritime because biomass is needed so widely across the economy, so we do not think that is the place to prioritise it. We are focusing there on the advanced fuels—the hydrogen and the ammonia. The Minister was just about to talk about everything we are doing to promote those technologies.

Trudy Harrison: I can clarify that the £206 million was indeed £206 million. It is for the UK Shipping Office for Reducing Emissions—UK SHORE. The COP26 Clydebank declaration is another example of how we are working internationally with partners. The reason for prioritising those six shipping corridors is to develop not just the fuel but the infrastructure. It is the vessels. It is a commonly used route as a way to prioritise the transition away from fossil fuels to a decarbonised maritime network, if that is helpful.

Q255 **Ruth Cadbury:** Thank you. I am going to move to roads. We are talking about not just private cars but fleets and vans and lorries. Are the

Government technology agnostic in their approach to decarbonising the road sector? How does the Government's financial investment in battery-powered vehicles and charge point networks compare with their investment in other alternative fuels for the road sector?

Trudy Harrison: Clearly, we have a lot more electric infrastructure in the country than anything else; we even have more electric charge points than petrol and diesel stations. The regulation is about being zero emission at the tailpipe. I will get Caroline to clarify exactly that regulation.

It is led by manufacturers because we set out the phase-out of new petrol and diesel cars by 2030. The latest stats are that there are about 29,500 public electric charge points on the network, of which more than 5,000 are rapid. We also have the commitment to Project Rapid, which will install a minimum of 650 kilowatt charge points on the 117 motorway service areas in England. We have the work that we are doing with local authorities. That investment from Government is just a proportion of the overall investment that is also coming from the private sector. I want to make it clear that it is not just Exchequer funding that is developing the transport network for electric vehicles.

In terms of hydrogen, while I think there are 14 public distribution centres for hydrogen across the country, we envisage that the transition for buses and heavy goods vehicles is more likely to be at their depots. That is why a public distribution centre may not be as necessary for the likes of hydrogen or other fuels.

We absolutely accept that we will need large charge point infrastructure installed in places like truck stops and motorway service areas. The work that we are currently undertaking with my colleagues in BEIS, with Ofgem, with the National Grid and with the DNOs—distribution network operators—is critical to ensuring that we do not just have the infrastructure for cars and vans now, but that we have the infrastructure, including the generation, the pylons, the distribution, the cables, the substations and everything else that is required for that higher-voltage requirement.

Q256 **Ruth Cadbury:** It is that point I want to pick up. It feels that we are lagging behind some other competitive nations on the provision of adequate grid capacity. I have heard concerns from motorway service station operators, residents of a block of flats in my constituency, fleet managers, people involved with the development of new housing estates and industrial estates and an EV manufacturer and seller in this country. They all raise concerns about the provision of adequate power to provide that network. There are issues about grid capacity and wayleave law, where landowners have the right to restrict access, for high-power cables particularly.

We need high power for fast charging, which is so essential economically for fleets. Will there be enough for the new housing estates and for the

overnight charging for the expected residents of those new estates? Are we going to be able to deliver all of this fast enough to catch up with our competitor countries?

Trudy Harrison: The UK has the highest number of plug-in electric vans sold in Europe. People are definitely purchasing these vehicles.

Ruth Cadbury: Exactly.

Trudy Harrison: That absolutely adds to the necessity to roll out the infrastructure.

In terms of generating, the Prime Minister set out in the 10-point plan a commitment to renewables and 40 gigawatts by 2030. I think point 3 is a commitment to small modular reactors, advanced modular reactors and gigawatt-plus reactors. A combination of renewable and nuclear will enable us to decarbonise electricity generation in this country. That is the responsibility of BEIS and not the responsibility of Transport.

From there, we are working with Ofgem. At the moment, I think it is fair to say that the pricing strategy is prohibitive. We want a "Dig once" approach. If there is a motorway service station situated a bit away from National Grid's network and we need to trench cabling or we need to build pylons and install higher capacity cable, we want to dig once.

We may not need the full capacity of power coming through, because heavy goods vehicles are not there yet. We want to be able to reserve that power for five years and possibly 10 years in advance. It is really important that we work with Ofgem because this is critical infrastructure for our nation. That is just one example of the generation, the reservation, the distribution and then the installing of infrastructure in areas where we have the parking, the access, the egress, the turning and the facilities.

The Chancellor recently committed to £32.5 million for better welfare facilities for heavy goods vehicles and trucks generally. We have a long-term vision on this. We are working with BEIS and with our partners. Broadly speaking, those partners are Ofgem, National Grid, the DNOs, the local authorities and the owners of the motorway service areas.

As I said before, it is not easy. It is incredibly complicated. Our current transport system does not work for everybody. It is important that we work with groups like Mobility to ensure that disabled motorists can also be part of this transport revolution. That is an important factor. This is an opportunity to make transport sustainable and safe, and available for everyone everywhere. We are not there yet. We want to be able to say that no driveway is no problem. In all honesty, we cannot say that yet, but the forthcoming electric vehicle infrastructure strategy will put some more flesh on the bones.

Q257 **Ruth Cadbury:** Thank you, Minister. A lot of the difficulties could be resolved. Do you need Government—I accept that there are other

Departments and not just Transport—to deliver them? You did not answer my question about wayleave law. Is that one of the constraints that needs addressing? Other countries do not have the same challenge there. I know that there has been movement for telecoms for wayleave law, but is electric cabling also covered by the law? Some are saying that even that law is not adequate for telecoms.

Trudy Harrison: Caroline will respond to the specifics of that particular law. In terms of the reservation, we are actively working with Ofgem at the moment. The other important thing is that it is all very well having this infrastructure, but if you cannot rely on it, it is as much use as a chocolate fireguard. We are also bringing in regulations to ensure reliability.

First, motorists, whether they are driving a car, a truck, a taxi or whatever, can find out where the charging infrastructure is. They can be confident that it will work. There will be penalties if it does not work. They can be confident that they can pay as they go rather than having to download yet another app—

Q258 **Ruth Cadbury:** I want to focus on the electricity provision.

Trudy Harrison: But to do that, we have to bring in the regulations. In generation, to ensure that we have load sharing, we have brought in, or are bringing in imminently, the default so that when people are charging their vehicles at home, that power will go on during off-peak hours. That is important for the balancing of the network.

On the wayleave, can you explain a little bit more, Caroline?

Caroline Low: You are absolutely right that consents to do the digging are often a challenge in implementation of schemes. It is something that we will talk about in the forthcoming infrastructure strategy. It is what we intend to take forward on the planning processes.

Q259 **Ruth Cadbury:** Planning? It is not planning. It is not town planning.

Caroline Low: The regulations around digging up the roads.

Q260 **Ruth Cadbury:** The problem is that it is common law and not legislation. That is the barrier.

I have one other question. Charging infrastructure in rural areas is often not commercially viable but is essential in order to decarbonise all communities and not just urban communities. What are the Government doing to ensure adequate charging infrastructure in rural and low-density communities across the UK?

Trudy Harrison: You are absolutely spot-on, Ruth. I live in a rural area, in a village of just 700 people. Sadly, in my area, we are down to about 51 chargers compared with 102 per 100,000 in London. We have half the provision in Cumbria compared with London. I know that we have a long way to go. There is a clear correlation between the willingness of people

to purchase an electric vehicle and the reassurance that the electric infrastructure is there for them. That is obvious. It is simply common sense. We are bringing out a rural strategy to look at that. Do we have dates on that, Caroline?

Caroline Low: We do not have a date yet.

Trudy Harrison: Rural areas will certainly feature in the forthcoming electric vehicle infrastructure strategy. I have made sure of that.

Ruth Cadbury: Thank you.

Chair: In a way, the challenges of electrification which we covered in our inquiry on zero emission vehicles led us into this inquiry in terms of "Is there an alternative fuel that can deliver and share the burden?"

To reset, we have covered the general Department's approach, the policies that are there and the schemes. We are now into the specifics. We are going to continue with road in terms of alternative fuels and what is available. Then we are going to go to aviation, rail and finally, but by no means least, maritime. Greg will continue with road.

Q261 **Greg Smith:** As an opener on that, and we touched on this a little bit in the opening questions, where do you see synthetic fuels playing a role in the decarbonisation of road transport? I am not just focused on passenger cars. I am focused on road freight, heavy vehicles and so on, as well.

Trudy Harrison: Broadly speaking, heavy goods vehicles fall into three categories. I do not think it is as simple as saying that this fits into a tonnage, although we have the ambition that by 2035 we will phase out the sale of diesel trucks of less than 26 tonnes, and by 2040 those of over 26 tonnes. There are exemptions to that, depending on the use type, the journey and other factors for that vehicle. I do not think it is as clearcut as saying that it is just about tonnage, but it is certainly an important factor. It is also about the cargo.

I have had the pleasure of driving a 19-tonne DAF LF truck around Leyland on their site. It was incredibly smooth, and I was impressed at how easy the electric 19-tonne truck was to drive. We broadly think that battery electric vehicles will be part of this, as will hydrogen fuel cell and potentially direct combustion using synthetic biofuels.

With rail, it is a similar kind of picture. At the moment, 38% of the rail network is electrified. It will be possible to electrify more areas, but in my area for example, on the Cumbrian coastal railway, because of various environmental restrictions, it is probably more likely that we will move towards hydrogen or other fuels.

It is horses for courses. It depends on the vehicle, on the weight, on its purpose and on its journey type. We are being led by industry on this, working very closely and collegiately through consultations. When are we

looking at our future of freight strategy coming out, Caroline? It is shortly. Can we be as seasonally specific as spring?

Caroline Low: I think so, yes.

Trudy Harrison: That will relay more of our findings. We have a number of trials happening that are crucial to understanding the different fuel types and uses. I pay tribute to the manufacturing industry. They really are stepping up. They need us to continue with the plug-in grants. At the moment, they can get up to £25,000 for the bigger trucks, and £16,000 for smaller trucks.

Q262 **Greg Smith:** That is helpful. Let's keep focused on the role of other technologies that are not there yet. In our first evidence session we had Zero Petroleum here, for example. They have developed the fuel. They have flown a plane on it so far, but they can develop it for road use as well, so we were told. It is not there yet, but you can see the path to it being commercially viable.

For heavy goods vehicles, where you can see a point at which, potentially, they will be carrying more battery than freight in order to give them the power to move the weight of the vehicle and the freight they are carrying, do you see a future whereby maintaining a combustion engine that has a drop-in synthetic fuel in those vehicles is potentially the answer to prevent the wheel essentially having to be literally reinvented?

You mentioned JCB earlier. Other plant manufacturers are doing this as well. They will be spending millions, if not billions, completely changing the mechanics of the product, just as the HGV sector will have to do, when the answer could be, "Keep what you've got and just put a different fuel in it."

Trudy Harrison: I am going to let Caroline, hopefully, relay some of the findings that we have discovered from our trials so far. I am very happy to write in much more detail about the outcome from those trials.

Similar to the argument with cars, when you have 70% efficiency from a battery electric motor, compared to 30% with a fuel cell and 20% with direct combustion, that is also a factor. It is the prioritisation of this fuel because we are going to need it for heat. We are going to need it for steel production, potentially, when we think about hydrogen. It is looking at the country as a whole. It is looking at the sustainability of the feedstocks as well, and whether we actually have security of supply of those feedstocks. It is then also the distribution.

It is fair to say that there is conflicting advice. Our job is to make sense of all of that in a comprehensive and holistic way, where sustainability is a factor but not the only factor. Deliverability and keeping the wheels of freight moving is incredibly important. We really learned the lessons of the importance of freight and logistics through the pandemic. Our work on the future of freight will be critical, going forward, as well as ensuring that we have the skills and the people in the freight sector.

Q263 **Greg Smith:** Caroline?

Caroline Low: We have been clear that for HGVs we are phasing out anything which emits at the tailpipe in 2035 and 2040 because those technologies exist. Both from the point of view of wider air quality and for reserving e-fuels for the sectors where there are not alternatives, the right thing to do in the HGV sector is to focus on the existing technologies.

As the Minister said, that is battery electric, hydrogen and potentially electrified roads. What we are working on now is not proving those technologies, because that has been done, but on how we roll them out at scale and what infrastructure is needed to support them. That is the job that we started with the £20 million of funding for zero emission freight trials over this financial year. We will be taking it forward with much bigger trials over the next few years.

Q264 **Greg Smith:** Thank you. I understand that point, but what I am trying to get to the bottom of is this. There is clearly a resistance, not to a blend but to an entirely synthetically produced petroleum, diesel or aviation fuel. As I mentioned, one of our early witnesses went through that. There appears to be a resistance to going down this path, which would potentially from a governmental perspective require, instead of a focus on the vehicle, a focus on the development of the fuel that goes into the vehicle.

Where is this resistance coming from? It seems that the answer to everything at the moment is, "Yes, but we are looking at hydrogen. Yes, but we are looking at battery." I am not hearing a lot about brilliant scientists who have developed something else that just works in what we already have.

Trudy Harrison: I know that we are fixed on the modes, but transport is more holistic than that. When we think about the need to replace the 12 million tonnes of kerosene for jet fuel, we are absolutely doing that. We have eight projects under the Green Fuels, Green Skies programme working with the likes of Velocys, LanzaJet or LanzaTech, Green Fuels and companies around the UK to do just that—to produce alternative fuels that can go into slightly modified existing engineering in the aviation sector for long haul.

Electrification is highly likely to provide an answer in aviation for the shorter haul, where you have fewer passengers, less journey and less weight. For the long haul that is exactly what we are aiming to do. To get 10% of sustainable aviation fuel is a big ask by 2030—just 10%. When you think of the need to replace that 12 million tonnes of kerosene in the UK for domestic and international, it is about prioritisation.

Where there is a way to do it with electric, we want to do that. Where there is a way to do it with hydrogen, there is a kind of hierarchy of what is available and what is more difficult to produce. That is the kind of prioritisation that you might see that we are doing. Bear in mind too, as I

said previously, that it is not just Transport. It is other Government Departments. Is that helpful in setting out the reason for prioritisation?

Q265 **Greg Smith:** It is. I get that all Governments have to prioritise, just as every private company does, what they are doing. What underpins my line of questioning though is the difficulty when it comes to balance and prioritisation. We have over 100 years of development of the internal combustion engine. They are about as efficient as they have ever been.

There is always room for greater efficiency. There are people who have sat where you are sitting and presented evidence that they have developed—difficult to produce right now, but technologies improve—fuels that do not put anything nasty out of the tailpipe and that work in those highly developed internal combustion engines, jet engines or whichever mode of transport you want to look at, which mean that we do not have to put people through the incredible expense, research and development of re-engineering vehicles, be they with wheels or wings or running on rails.

Why are we not more focused and prioritised around saying, "Well, we've got the technology of how the vehicle operates," whatever the vehicle may be, particularly vehicles that have to pull or fly with significant weights or loads? You said yourself that hydrogen is difficult to produce in a decarbonised green way, so there is going to have to be all of that effort in producing hydrogen. Why not put the effort into producing something that equally works in what we have already got?

Caroline Low: The key point you made about them putting nothing nasty out of the tailpipe is the issue. We have been very clear in the regulation for net zero at the tailpipe. We have not said that it cannot be e-fuels, but we have seen no evidence that e-fuels can deliver the air quality benefits that come from a battery/electric or hydrogen fuel cell car. That is the real challenge. They deal with the carbon, but they do not deal with the NOx and other emissions.

Q266 **Greg Smith:** My final question is a very brief one. We had evidence from Logistics UK, that the industry is "a long way from having a reliable market ready zero emission HGV that can transport goods across" the entirety of our United Kingdom. What do you think is the realistic timeframe when all HGVs on UK roads will be at zero emission standard?

Trudy Harrison: We have committed, for 26 tonnes, a phase-out of new diesel trucks by 2035 and the phase-out of new diesel trucks over 26 tonnes by 2040 as a starting point. You mentioned the potential for hydrogen to then provide syngases using carbons through carbon capture, and so on. We are developing all of those. It is not that we do not want to hear about them—

Greg Smith: I am not suggesting that.

Trudy Harrison: I think the priority for those kinds of fuels at the moment is more in aviation, which is why we have those eight projects funded by the £15 million. It is part of an £180 million fund to

commercialise sustainable aviation fuel. It is not just developing the fuels. It is commercialising them and making sure that we have a clearance process for those fuels as well.

We see the role for synthetic fuels more in aviation, which is incredibly difficult to do, simply because of the fuel requirements.

Q267 **Greg Smith:** I heard that. I am sorry to cut across you. My point was that, no matter what the technology, Logistics UK told us that we are a long way off. I get the dates by which the new vehicles will not be able to be sold. The magic number is 2050. With evidence from the industry that we are that far off, is the technology going to catch up—it doesn't matter what the fuel is—so that HGVs are actually zero emission by the magic date of 2050?

Caroline Low: I would say yes. If you talk to truck manufacturers, that technology is well developed. It is now much more about rolling out the infrastructure needed to support it. There have been various studies on what the costs to industry will be of adopting that technology. What we are seeing is that relatively soon the total cost of ownership will be pushing industry towards choosing those battery/electric and hydrogen vehicles.

It is possible, as we are seeing in cars, that once that transition happens it will go quite fast. Of course, we cannot perfectly know what is going to happen between now and 2050. We have to keep coming back to these policies to understand what more we need to do to support, and whether there will be a need for e-fuels in HGVs beyond 2050, if there are still some on the road. Those are decisions for later.

Greg Smith: Thank you very much.

Chair: I should have brought Karl in beforehand. My apologies, Karl. Over to you.

Q268 **Karl McCartney:** It's not a problem at all, Chair.

It will not surprise you, Minister that I want to go back over some of the stats that you used on my last questions. You mentioned that electric motors were 70% efficient compared to other forms. I did not really catch what the other ones were. Does the 70% for electric motors include the generation of the electricity to get to those motors or not? I think you might be picking and choosing what statistics you are giving us, compared to the efficiency of ICE.

Trudy Harrison: Karl, let me write to you with the specifics of that. If I am honest, I am not sure whether it includes the electric generation. I doubt that it will. I think it is more about the engineering of the vehicle and the way that the power translates to turning the wheels.

Q269 **Karl McCartney:** That is why I want to know because, obviously, in the line of questioning since Greg and I asked you, it is about comparing like with like.

Trudy Harrison: I understand, yes.

Q270 **Karl McCartney:** I would say there are quite a few people, even before the last three months, who have been very sceptical and cynical about the "All eggs in the electric basket" approach that it seems our Government have decided to take with electrification, infrastructure, the grid capacity and the ability perhaps of all 35 million road users in the UK to be in electric vehicles, whether that is by 2030, 2040, 2050, or even at some other point to be determined in the future.

With that in mind, should or could synthetic fuels be used to decarbonise the rural roads sector specifically? If so, in which vehicles do you think they could best be utilised?

Trudy Harrison: I have particular concerns. I have raised this with the team, based on my own experience. I have a number of mining towns where you have that typical terraced street upon street, and parking is a challenge, never mind finding an electric charge point. I actually had the pleasure of responding to Ben Bradshaw when we were talking about car clubs and the other options, such as Liftshare, for being able to drive, bearing in mind that a car is stationary for a vast proportion of the time.

I have said before that we are entering a new era in how we use our cars. It is not necessarily with a driver and not necessarily as a status symbol on our driveways. In rural areas we are particularly dependent on our cars. My four daughters would not be able to do their jobs if they did not have their own car. I am less reliant; I am probably the person who does the least driving in my family.

I absolutely understand the challenge of how on earth we will ensure that no driveway is no problem. We are working with industry, scientists and innovators to find different ways of charging, but never say never. I am not ruling out that approach because it is going to be difficult. I certainly would not stand for rural people, particularly people who need to drive their cars, not being able to do so or being disadvantaged because of caring responsibilities or the difficulty in accessing the charge point.

I am extremely mindful of the challenges of the electrification of cars. There are many ways that we can ease the burden, but I am not ruling anything out because it is important—

Karl McCartney: You can understand that there is scepticism, as I have said, and there is perhaps cynicism from some of us who believe that there are other options. That is why we have particularly asked you about sustainable fuels to drop in a fuel tank instead of fossil fuels.

I have one final question, Chair.

Chair: Please be brief, because I want to give 15 minutes for each of the other sections.

Q271 **Karl McCartney:** Are you looking at other countries and what they are looking to do, and maybe not taking lessons, but at least having an open

mind? I am particularly thinking of China where, certainly in the next few decades, there are likely to be a billion more vehicles as their middle classes wish to have their own vehicles. Are you looking to see what they are going to be fuelled by? How are they going to be powered?

Is it all going to be electric? Many of us think it is probably not, considering that, as we have seen over the past few months, how countries are fuelled and where they get their energy from is very important. Yes, I have just mentioned China, but in India you also have a rising middle class where, I am sure, there will be another billion people in the next 10 years who will want air conditioning, and air conditioning runs off electricity. The world market in electricity is going to be phenomenal. Electricity is probably not going to get cheaper. Do you do that within your Department at all?

Caroline Low: We absolutely do. I am sure that the Minister can talk about all the people she met at COP26, which was a fantastic opportunity to talk to other countries about what they are doing. I have not been to China. We look carefully at what is going on in their market. There is a new Chinese electric car about to be launched in this country—the Ora Cat—and the development that is going into electric cars there is phenomenal.

We talk a lot to our counterparts in California to understand what they have done on the ZEV mandate. We look at what is going on in the Netherlands and in the Scandinavian countries in the infrastructure roll-out there. Yes, of course we look at what is going on in other countries.

Q272 **Karl McCartney:** Do you look at where the world market in raw materials for batteries, and so on, is going?

Caroline Low: Yes. That is obviously a key point for the whole of the automotive sector at the moment, not just electric vehicles.

Mr Bradshaw: The Minister mentioned this at last week's Adjournment debate, and since then the organisation has brought out research showing that the average family can save themselves £2,000 a year by giving up a car and using a car-sharing scheme or a car club. It operates in rural areas as well. Perhaps when she comes to Devon to look at Co Cars, she might like to bring some of her more EV-sceptical Conservative MP colleagues along with her.

Karl McCartney: We will even share a car on the way down there.

Q273 **Chair:** Minister, do you want to respond to Ben?

Trudy Harrison: Yes. It has been a revelation to me, Chair, to learn about Liftshare and other car clubs. I know that Ben himself was a founder of Co Car in the Exeter area. There is real value in looking at this. It is not about reducing cars. It is absolutely not banning cars. I love cars. It is looking at new ways to use a car without it necessarily being stationary on the driveway for such a large proportion of time. The

hardstanding that is necessary to park the car could be a more biodiverse front garden.

These are some solutions. Working with local authorities and partners, and learning lessons where it has worked particularly well, is going to be important. Ultimately, it makes transport more accessible to everyone. I think it should be viewed in a very positive light. With the increase in the population that we expect, the increase in development and the need to think differently, but with the same aims, people can enjoy the same things but just do them differently, more sustainably, and more sociably perhaps.

Chair: That seems like a suitable offer for a harmonious road trip with yourself, Minister, Ben and Karl. I am sure you would agree on everything all the way down to Exeter. Let's do 12 minutes for each of the other sectors. We will start with aviation and then go to rail and maritime.

Q274 **Gavin Newlands:** Thank you, Chair. That sounds a great idea, as long as we film it.

Minister, you mentioned the SAF mandate earlier and that it provided certainty. Certainly, a lot of the Government's overarching policy in this area sounds good. A proposed SAF mandate is welcome but, as Velocys and many others state, it does not provide certainty because it does not provide any kind of guarantees on price, which again is something you mentioned. Pretty much everyone I have spoken to in private meetings—people in and outwith the SAF sector—has said that the only way to move forward at the pace required is to introduce something along the lines of a contract for difference model, as we have had with wind. Are the Government seriously considering that? Can you give me more details on it?

Trudy Harrison: We are certainly seriously considering the best way to support the aviation industry, the investors, the fuel producers and the distribution companies in all of this. Contracts for difference are being considered. It is not necessarily that we will definitely support that financial mechanism. It has worked across Government for many significant infrastructure projects.

Equally important is the SAF mandate to provide certainty to the market. We think that will drive down the costs as well. Caroline can go into more detail on any of the findings that we have so far from industry, particularly timelines for when we will be able to say more about if, or how, we might roll out a contract for difference.

Q275 **Chair:** Caroline, perhaps you can also address what the pitfalls of the CfD mechanism would be at the same time.

Caroline Low: We have beefed up the team that is working on potential price support mechanisms and taken a secondee from industry, which we are very grateful for. A great deal of work is going on. There is a huge

amount of complexity in putting in place that kind of mechanism in how it is ultimately paid for and which feedstocks are supported by the mechanism. The detail of how it works will need significant consultation.

In terms of the timing, we will shortly be responding to the consultation on the SAF mandate and setting out next steps for any price support mechanism. We have started that. What it is important not to lose sight of—we had an investor conference on this recently—is that there are three stages to producing these advanced aviation fuels: the feedstocks and certainty of supply of the feedstocks; the technology, which is still at a very early stage; and the offtake. We need to be working on all three of those in parallel and not get totally focused, to the exclusion of everything else, on the price support mechanism.

The competitions we are running and the money we are investing to support these plants setting up in the UK are absolutely vital. For these projects to become fully investable at scale, we will need to be further along the technology curve as well as putting in place any price support.

Q276 **Gavin Newlands:** If there is a price support mechanism in place, or CfD—whatever we want to call it—some of the other work that has to happen in tandem would happen a lot quicker with larger private investment coming in.

Caroline Low: The message we got loud and clear from the private investors is that they need all three of those before they will invest serious money. I think that we are progressing the investment in the technology at speed.

Trudy Harrison: You may well be right, Gavin, and that is exactly why we are considering it. I am far from ruling it out. What I am saying is that we are gathering the evidence, and we will be able to report back in the short term.

Q277 **Gavin Newlands:** I appreciate that, but you mentioned timelines and that it is urgent. Obviously, we have a net zero deadline. For instance, Sustainable Aviation said: "Without urgent policy action on SAF we will lose an opportunity to build a domestic SAF industry and the associated economic benefits of first mover advantage." I think I am right in saying that this is something you have been doing in DFT with industry for two years now. You said you have beefed the team up, but where is the urgency? You talked about timelines, so can you give us a date by when we will hear what the Government's plans are on this?

Caroline Low: I cannot give you a precise date.

Gavin Newlands: That would be unusual, to be fair.

Ruth Cadbury: It's the third or fourth time today.

Q278 **Gavin Newlands:** Exactly. Could the CfD model or support mechanism be used for other alternative fuels and not just sustainable aviation—for hydrogen, and so on? Is that something you would potentially look to roll

out across the piece rather than just for SAFs?

Caroline Low: We expect hydrogen to be one of the fuels that would be included in any SAF mandate. There is also a debate about whether fuels derived from energy from nuclear are included in any SAF mandate and price support mechanism. That is where we have to work closely across Government to make sure that the support schemes we are putting in place do not cut across schemes that BEIS is putting in place to bring forward the development of renewable generation and hydrogen.

Trudy Harrison: That is a really important point to reinforce. Diesel is a universal fuel. Kerosene is a universal fuel. That is why it is so important to work with BEIS on these support mechanisms. Whatever we develop will not just be the solution for aviation, or even for transport; it could also be the solution for heating fuels. Of the energy make-up, I think about 17% is actually electricity. The rest is other forms of fuel. There is huge scope across Government.

Potentially, we could be the breakthrough. Our trials could be the breakthrough to find the alternative fuel that could be used in many different sectors and technologies. We are working closely with BEIS to understand what the best support mechanisms will be, and that might be contracts for difference.

Q279 **Gavin Newlands:** I am conscious that I need to hand over to my colleague. To be clear, I am guessing that we will not hear anything concrete in the spring statement next week. Might we hear a nod to this issue in the spring statement next week from the Chancellor?

Trudy Harrison: I am afraid that I cannot confirm either way, I am sorry.

Q280 **Gavin Newlands:** You can but ask.

Trudy Harrison: You certainly can. I hope we have got the message across that it is not just the financial modelling. It is the certainty; it is the mandates; and it is the sustainability of feedstocks. There is a plethora. It is an ecosystem that we are developing.

Q281 **Chair:** I want to clarify this for our evidence. We have been given evidence from the producers that SAF can be produced right now.

Trudy Harrison: It already has been. It is already being used, yes. There were 400-odd flights by BA during COP and about 40 flights by easyJet. It is already being used.

Q282 **Chair:** They are right in that regard. They say that you can actually get it from three origins: recycled oils; household waste, or waste; and the air. They are right on that front.

Trudy Harrison: Yes.

Q283 **Chair:** So it can be produced. Are they also right that at the moment you cannot get private investment on it because there is concern about the

return for your investment? There is no financial market for it.

Trudy Harrison: Saying that you cannot is quite a general statement.

Q284 **Chair:** It is limiting production.

Trudy Harrison: I would have to provide more information on the extent to which it is easy to secure private investment, and more detail on the extent to which the private sector is investing in aviation fuels at the moment. Can it be used? Yes. Has it been used? Yes. Do we have the capability within the country to do it? Absolutely, yes, but to do it at a commercial scale where it is competitive with kerosene, which is the jet fuel of choice at the moment, requires a lot more R&D and policy—

Q285 **Chair:** I am going to interrupt, if I may, because I am already eating into other time. This is important for us because we are trying to test the evidence that we have been given. Is it also the case that you believe the CfD market was successful for the low-carbon energy production market?

Caroline Low: Yes.

Q286 **Chair:** Okay, so that is also the case. Adding all of that together, I cannot understand why there is reluctance, or time is being taken, to bring in the CfD model. Is it because you believe that the industry is wrong when they say that it will not cost the Government anything? Are you concerned that Government will have to be the backstop guarantor if the strike price does not come—

Trudy Harrison: There are lessons learnt from Hinkley Point C. Yes, we used the contracts for difference method to fund the 3.2 gigawatts of nuclear power station that Hinkley C will bring on, but are we going to do it again? Absolutely not. That is why we have put so much effort into developing the regulated asset base for future gigawatt-plus reactors. That is just one example of how CfD has funded the low-carbon energy sector, but we will not do it again.

All those considerations need to be borne in mind—the unintended consequences—which is why we are taking some time, and I think it is right that we take some time, to develop these financial models.

Caroline Low: To be clear, there is no reluctance to pursue this. There is an issue of resource capacity and the speed at which we can go on something very complex. I want to be clear that it is not the silver bullet that solves everything because we still need to do work to scale up these technologies. There will be a decision about whether waste feedstocks are allowed, but if they are, there is a constraint on those feedstocks. In terms of our commitment to supporting the development of future fuels for aviation, we are very clear that that is what we are doing.

Chair: I will leave it there because Simon should have his time.

Q287 **Simon Jupp:** Building on that topic, when we are talking about the future of aviation it is quite an exciting time after a very difficult two

years for the industry. Do you think that hydrogen-electric aircraft will ever mean the phasing out of the much talked about and much lauded sustainable aviation fuels?

Trudy Harrison: I doubt that in coming decades hydrogen-electric will get us over the Atlantic with a plane capable of taking both hundreds of passengers and cargo in the belly. Will it ever be possible? I am neither a scientist nor an engineer. I have absolute confidence in the scientists and engineers of this country to find those solutions, but realistically from the information that we understand at the moment and the trials and successes that have taken place, we are probably looking at domestic flights depending on electrification and hydrogen, and a different kind of technology and fuel for transatlantic and long-haul freight.

Q288 **Simon Jupp:** What is your best guesstimation, and evidence if you have it, of when we could see a transition to that, domestically at least—hydrogen-electric flights from the Highlands to the south-west, for example?

Trudy Harrison: That are commercially viable and that people could afford to buy a ticket for?

Simon Jupp: Yes.

Trudy Harrison: I am afraid, much as I would like to hazard a guess, that I cannot at the moment. Part of that is the cost of hydrogen—

Q289 **Simon Jupp:** What if I promised I would not buy any duty free so it was not too heavy.

Trudy Harrison: The significant thing is bringing down the cost of hydrogen and doing that in a sustainable way. The hydrogen strategy that BEIS brought out has a call for evidence on how we might use renewables to produce hydrogen and how we might use both conventional nuclear power stations and high-temperature gas-cooled reactor power stations. There are thermochemical ways in which we can produce hydrogen as well.

I should, Chair, declare some sort of interest because I worked at a nuclear power station, my husband works in a nuclear power station, my daughter works in a nuclear power station, and we are the centre of nuclear excellence. I refer Members to my interests in that regard, which will perhaps explain my knowledge.

Q290 **Chair:** We have taken it as a given as your constituency is Copeland, but thank you.

Trudy Harrison: We are working with BEIS on how we can bring down the cost of hydrogen, but also looking at how renewables can play a part without detracting from the grid requirements of electricity. To produce hydrogen from renewables, to make it clear, you produce the electricity that then powers the electrolysers that then split the water, to then

provide the hydrogen, to then go into trucks that might be better powered by battery-electric in the first place.

Q291 **Simon Jupp:** Understood. Obviously, an awful lot of work is going on there. We have talked about how the Government are technology agnostic when it comes to this and that you are investing in different projects and ideas across the country to see what the best option is and what will work for the future. As much as that is providing an awful lot of excitement for the industry, there is quite a lot of uncertainty as well for the aviation sector after a very difficult two years. I am particularly thinking about the impact on domestic airlines that fly domestic routes across the United Kingdom, as well as regional airports.

Once we get to a point where we know what we want to focus on, how do you think the industry will need to be supported to make sure that it can adapt to those changes? Given the amount of investment being given to research, obviously the end game will be that people can fly between regional airports, for example, because the technology is there on both sides to refuel, whatever that may be.

Trudy Harrison: We are investing about £1.9 billion to support the industry to transition away from fossil fuels. You are absolutely right that it is being done through trials and in partnership with the industry. In terms of how airlines price tickets in the future and how we will count carbon and incentivise passengers, that is a commercial matter for—

Q292 **Simon Jupp:** I am talking more about the infrastructure on the ground. For example, if you are flying between Edinburgh and Exeter, and at the end of that, on both sides of the journey, you need to refuel the plane, the infrastructure required for that will be quite involved, one would imagine. How do you think the industry will need to be supported through that transition?

Trudy Harrison: It is a case of using that £1.9 billion through the Aerospace Technology Institute, which is being match-funded by industry as well. We have about 40 airports across the country, including the large and the regional. Maybe Caroline can explain a little bit more about how the trials are exploring the infrastructure and distribution requirements for those fuels, as well as the basic infrastructure that an airport needs.

Caroline Low: It is just that. We have live trials where we are testing the infrastructure needs at airports. It is very early days for that. As we were discussing earlier, we expect to see the process that is playing out for the moment in passenger cars gradually happening in all of the industries. In aviation we are very much at the stage of understanding the technology and just getting basic working technologies. Then we will start to scale up and understand the infrastructure needs, and work with industry on the Government's role in supporting that.

Simon Jupp: It is very much an ongoing discussion. Thank you.

Chair: We are going to move on to rail now, and we're back to you,

Simon.

Q293 **Simon Jupp:** You are indeed. Lucky you!

We have already talked quite a lot about biofuels during this session. You have explained about aviation, and the need to decarbonise and improve the green credentials for that industry is clear for all to see. Given their limited availability, should the use of biofuels be prioritised in other sectors such as rail to try to help that industry too?

Trudy Harrison: In the UK, 38% of the rail network is already electrified. That will continue and it will increase. The investment that we are making in rail is unprecedented, but at the moment I am afraid it is similar to the response on aviation, and indeed maritime; we are working with industry to understand from trials and from research and development which journeys, what are the restrictions, the length of journey and the type. You could far more easily convert a diesel train to a battery-electric train for passengers than the likes of freight. Freight is really tricky.

Caroline can talk about the trials of HydroFLEX and the number of research and development programmes that we have going on at the moment. The progress to date and timescales would be helpful.

Q294 **Chair:** We took evidence from Helen, who was the engineer responsible with the University of Birmingham for HydroFLEX.

Trudy Harrison: Excellent.

Caroline Low: You have heard about the hydrogen and battery-electric trials already going on. We have the technologies on rail. It is really a question about what is the most value-for-money thing to deploy and where. Electrification, where it makes sense for the taxpayer, is being rolled forward.

The current trials on hydrogen and battery-electric will tell us, as the Minister said, what the scope for those technologies is. There may still be a place for a limited amount of biofuel for the heaviest trains. Those technologies do not even have to be train by train. We already have bi-modes on the network. It may be that some combination of battery-electric and catenary is the solution for many lines where there are tricky sections to electrify, but other areas where it is more cost-effective.

Trudy Harrison: To explain the extent of the problem that we are trying to solve, in addition to that 38% of electrified trains, we use about 620 million litres of diesel on our rail network. There is a fantastic opportunity for alternative solutions.

Q295 **Simon Jupp:** You have neatly led me to my next question, which is regarding diesel. The Government have announced their plan to phase out all diesel trains by 2040. Are you confident that we can meet that target?

Trudy Harrison: Yes. Will it be easy? No. It is exactly why we are working with industry to understand how. I think we all agree that it is a good idea to phase out the use of fossil fuels on the rail network. Saying that, it is only responsible for about 2% of emissions at the moment. Rail is an impressively environmentally friendly way to travel, but we can and should do more, because we can do more. Working with industry and the research and development trials will be critical to that.

The short answer to the question is, yes, it is possible, but it requires urgency and a pragmatic approach.

Q296 **Simon Jupp:** Of course, you have your ambition and it is a laudable and an important one. You are also investing in new train lines across the country and things like that. They will need to be serviced sometimes by existing trains. I am thinking about other lines that are coming into play; for example, East West Rail. Are you continuing to invest in a diesel railway infrastructure?

Trudy Harrison: We are because we are in a transition. At the moment, we do not have the technology. We certainly do not have it commercially available at the moment. As with all of the modes, it is about a sensible, pragmatic, proactive transition to net zero by 2050.

Q297 **Simon Jupp:** It somewhat delays your ambition, doesn't it, if you are continuing to invest in old technology before you invest in new technology? I understand the challenge.

Trudy Harrison: Some of them are bi-modal. You can have both the diesel aspect and another technology on a train that does not require fossil fuel. Some of that is the bi-modal, hybrid solution.

As to how many trains will be running in the short term on diesel, I am not the Rail Minister so I am afraid I do not know the answer to that. Again, I am happy to provide that information unless Caroline is more knowledgeable than me on the current mode situation.

Caroline Low: I know that on East West Rail the challenge was the value-for-money case for getting on with it and doing something now versus understanding what the most cost-effective technology would be. I believe that that line is being built with passive provision for electrification, should that become the most value-for-money technology to decarbonise on the route. At the moment, that is not certain as we continue—

Q298 **Simon Jupp:** You said passive. What do you mean?

Caroline Low: I am not a rail expert either—

Q299 **Simon Jupp:** Do you mean that it could be switched fairly easily? Is it like HD-enabled, which is not really a thing?

Caroline Low: I think I would need a rail expert to explain, but I imagine it is about building the infrastructure in a way that makes it straightforward to put wires up later if you want to.

Trudy Harrison: We must also bear in mind that this is taking cars off the road, and that is also a priority. Even if it is using diesel, it is potentially better viewed than having cars on the road, to improve congestion and to improve the kind of environmental concerns that we have in towns and cities. It is also to provide for freight alternatives.

Simon Jupp: Thank you.

Chair: I want to focus on East West as a case study, not least as it is in Greg's constituency, so over to Greg.

Q300 **Greg Smith:** Thank you, Chair. On the East West Rail point, this is a brand-new and entirely taxpayer-funded railway. I am not opposed to it. My constituents, as well as those in neighbouring seats, like the idea of East West Rail. It will be a very productive railway. It is not like the other one going north-south. However, on the Government commitment that Simon talked about to phase out all diesel-only trains by 2040, trains last a lot longer than 20 years, so how can it possibly be right to build a new one that will have diesel-only rolling stock from day one when it launches in a couple of years' time? Those trains are still going to be rolling well beyond 2040.

Trudy Harrison: The trains that I have been on were diesel and they were converted. It is not to say that because it was made for a diesel system it will always be a diesel system. It is absolutely possible to convert diesel engines and carriages in the future.

Q301 **Greg Smith:** The point I come back to on this is that, if we cannot build something fresh that meets the Government's decarbonisation targets, what signal does that send to the rest of the network, which is trying, through individual operators and the advent of Great British Railways, and so on, to decarbonise the fleet in time?

We are in a different place from road vehicles. Yes, a car can last a very long time, but most people keep a car for five years, or maybe 10 years. A train is with you, accepting that it can be converted, for a very long time. Purchasing decisions today are what is going to be rolling, converted or unconverted, for a very long time. Surely, to meet that commitment, you have to start the way you mean to go on.

Trudy Harrison: I have absolutely no doubt that that would have been the intention. What I am not aware of is the impact assessment of taking the decision—for example, the availability of hydrogen at the moment. Green hydrogen in this country is incredibly limited. If electrification was not the solution for whatever reason, and we were instead looking at a hydrogen fuel cell train, we would need to be sure that the hydrogen was available for all the journeys in a sustainable way. I do not think at the moment that we have the confidence that it is either sustainable, because

we do not have the provision of green hydrogen or pink hydrogen, or commercially viable.

However, I am not going to get myself in knots trying to argue. I will obtain the methodology for that decision. I am pretty confident that it is not a forever decision, and that the conversion will be perfectly possible. I have already travelled on those trains.

Q302 **Greg Smith:** I appreciate that, but the Chiltern line, which intersects with East West Rail, is already piloting bi-mode, hybrid trains. They have converted that stock. Yes, I accept the point that hydrogen is not necessarily as polished as it could be and that there are supply issues with it but, going very local, it is about the interests of my constituents in Winslow, Newton Longville or Verney Junction who have the line directly behind their homes.

The point in your target is diesel only rather than no diesel. Why not do those retrofits before a new railway is launched, so that you are launching with battery-enabled traction through built-up areas in and out of stations, and running on diesel in open countryside?

Trudy Harrison: I will come back to you with the rationale behind that decision. Clearly, that would be what we want to do. We have an ambitious commitment as it is, and we needed to start yesterday. That will have been the ambition but, for whatever reason, it has not been the decision at the moment. Let me come back to you, Greg, with the specifics of the methodology of that decision.

Chair: We end on maritime, which is the right place for us to end. When we took evidence, it appeared to be problematic, first because there seemed to be no alternative fuels, or indeed electrification, right now and, secondly, because it requires a global solution rather than just the UK. With that challenge in mind, we will start with Gavin Newlands.

Q303 **Gavin Newlands:** We touched on elements of the RTFO earlier, but it would be helpful if you could summarise the Government's current support for decarbonisation in the maritime sector.

Trudy Harrison: Domestically, maritime emissions are 5%. We envisage that shipping is likely to be ammonia from green hydrogen, carbon capture and batteries. The average lifespan of a vessel, similar to rail, is 25 to 30 years, which is why we have a commitment that by 2025 new vessels will have the capability to be low carbon. It is why we have just announced £206 million for the UK shipping office. It is the biggest investment that the Government have ever made in maritime to unlock that transition.

We have the COP26 Clydebank declaration. We had 20 signatories to the green shipping corridor. They were international signatories, which is so important because shipping is international. It is no good having a fuel that is available in Immingham or Felixstowe, but is not available at its destination. That is the reason why we have opted for it in the shorter-

term, although 2030 is fairly medium-term. It will be challenging to come up with those green shipping corridors. We hope that there will be more than six, but that is the approach at the moment.

Q304 **Gavin Newlands:** The Chair is absolutely right, and you have made the point yourself, that this is global and challenging. We have already launched a maritime inquiry. We are looking forward to visiting the International Maritime Organisation in the next few weeks.

You mentioned the Clydebank declaration. Obviously, I have a vested interest as it is just over the water from me. Can you give a bit more detail as to what you are actually doing in those international forums with the 20 signatories and others? It does not always move quickly when something needs a global solution.

Trudy Harrison: Absolutely. Again, it is similar to aviation. It is looking at the feedstocks that might be required. It is looking at how we can ensure the hydrogen or ammonia production. It is looking at how we can make that safe both at ports and when sailing. It is also about the infrastructure that is required at ports as well.

I will let Caroline go into more detail on where we have got to in the timescales. It is working collaboratively with the understanding that we want to be net zero by 2050. It is looking at what the international communities are doing as well, and the sustainability and availability of their feedstocks. I will let Caroline explain a little bit more about the trials so far.

Caroline Low: It is worth touching on the work of the International Maritime Organisation. As in aviation, what is vital is that we have a shared international view of what the trajectory is to net zero and market-based mechanisms that work across borders, otherwise we could do something here and find carbon leakage, and not achieve our goals at all. I believe that the IMO are focusing on that point in their May meeting and looking at the market-based measures they propose bringing forward for the whole of the maritime sector, and the dates that those would be targeting. That will be really important.

What is important for us is having a real leadership role as part of that, in both the debate and the ambition, and in the technologies. That is where the competitions come in. There was a competition this financial year which I think funded 55 different projects doing all sorts of things, both in the technology on the vessels and in the ports. We keep coming back to this point. The infrastructure and getting the power to the ports, getting the fuel storage facilities at the port, will be key. We then have much more money to take those trials forward at scale over the next few years.

Trudy Harrison: Is it worth talking about Operation Zero as well? That is a collaboration of about 30 businesses with similar aims in maritime. Where are we with the timescales on that?

Caroline Low: I believe that is a live project looking at electrification of the fleet that serves the wind turbines offshore.

Q305 **Gavin Newlands:** You mentioned a couple of things that I want to drill into. I understand that if the IMO are going to come out in May potentially, or perhaps beyond, with their own recommendations, that would inform the UK Government's approach, and the new shipping office. I understand that. There are areas that can be moved on in the meantime, like some of the infrastructure at ports. We have been speaking to people who talk about shore power and trying to get renewable electricity to ports. If I could drill down, what are you doing to support that right now?

Caroline Low: There is a live consultation at the moment on the electric infrastructure needs of our ports. Once we have gathered the evidence from that, we will, of course, be thinking about how we take it forward. I anticipate that there will be a great deal of learning from the work we have been doing in the vehicle sector, getting the power to the motorway service areas, which we will then be able to translate into the ports sector, once we understand what the exact needs are at the different ports around the country.

Trudy Harrison: It is worth explaining that the future of freight plan also plays into this, because so much of freight action takes place at ports. While that is not just focused on the decarbonisation of the freight industry, it is about ensuring that we have a planning process that supports freight and that we have the ability to bring in the power cables and hold highly volatile fuel. We are talking about ammonia or hydrogen. It is not easy. It also looks at how we will ensure that we have basic, essential infrastructure.

There is the role that technology can play. I recently visited Hamburg, which I think is the eighth biggest port in Europe and fifteenth in the world, to see how automation is playing a part, as well as the use of LNG and other more sustainable fuels. It is a lot of talking. It is a lot of conversations and working collegiately and collaboratively with industry, because they know their sector best. We will be led by what is the art of the possible with Government support, nudging Ofgem or National Grid to provide the electricity, and working with the fuel providers we already have in the country to develop sustainable fuels and to develop a pipeline for the supply of future feedstocks.

Gavin Newlands: On that international work, could you write to us and tell us what you have been doing since the Clydebank declaration? Perhaps you could say what work is planned in terms of the UK taking a real leadership role in this. That would be quite useful for us. There are lots of consultations for us to keep on top of, Chair.

Q306 **Chair:** Indeed. To close, is net zero for maritime a Government goal or ambition for the sector, or is it an absolute requirement for the sector?

Trudy Harrison: We have committed to net zero by 2050 as a country. For some industries, and I do not yet know whether maritime will be one of them, it will not be possible to be net zero and there will be some level of carbon offsetting, carbon capture, and so on, but that is certainly our intention.

Caroline Low: There is a technical point there in terms of the way carbon budgeting works. We have agreed or decided to take international aviation and maritime into the UK's carbon accounting from carbon budget six.

Q307 **Chair:** Indeed. I think the Minister was alluding to that. Am I right in saying that there might be certain sectors where you cannot deliver it by 2050 and, as a result, other sectors might have to work harder so that you can get to net zero for transport overall?

Trudy Harrison: I am not aware of an overarching transport plan where some parts of transport would have to bear the burden more than other parts. I think it would be done more as an overarching country or nationwide solution. There isn't anything, is there, in terms of legislation or plans?

Caroline Low: In aviation, it is possible that there will be some carbon capture and storage to get us to net zero. In maritime, I think it is too early to say whether we can get to absolute zero or whether it will be net zero with some offsetting.

Trudy Harrison: Some of the work we are doing as part of the eight programmes in Green Fuels, Green Skies is taking that carbon. It is not just a case that it would be carbon capture and then just depositing it in the North sea, for example. It can be the case that we could use that carbon with other biofuels to create fuels of the future as well.

Q308 **Chair:** The reason I ask is that within maritime there seems to be no current solution yet. We hope that there will be, obviously, but it requires global delivery. It cannot be credible to say that we will have net zero by 2050. That has to be an aim, but as things stand currently there cannot be any credibility in saying that it will absolutely happen. I think you, yourself, Minister, have recognised that.

Equally, where it is within gift, but seems to be going far too slowly to deliver, is on rail, where electrification will have to go at such an advanced pace that you just will not get there by 2040. If the indication on East West Rail is that we are building a brand-new rail line but we are not even going to start with electrification, that would also lead us to conclude that you will not get to net zero and decarbonised rail by 2040. That was the reason why I asked whether other sectors are going to have to take more of a load, where it can be delivered, with surface car being a good example. It seems to us that those other modes cannot be achieved as things stand.

Trudy Harrison: I put it to you, Chair, that if we had been having this conversation about electrification of cars 10 years ago, you might have presented a similar kind of challenge, and just look how far we have come: 140 manufacturers, makes and models; one in six cars; charge point infrastructure; and customers really showing their appetite for the transition to electric vehicles. That is the art of the possible. I think we need to learn lessons from the transition from a fossil fuel to a low-carbon economy in cars and roll that out across other modes.

Q309 **Chair:** I absolutely agree. I take that point. We are not a bunch of Luddites on this Committee. We are always interested in future tech and innovation, but on rail, electrification has been in place for years. The issue with electrification is that there are 10,000 kilometres to deal with now. Right now, electrification is the only mode that works at the freight level in terms of how heavy the weight is and the speed. It is tried and trusted, and it works. If we work on the current trajectory, unless there is a massive ramping up of the electrification programme, it is just not going to get delivered.

Trudy Harrison: At the moment our focus is really on the security of the energy supply. Right from the very top in Government, the Prime Minister has set that out. The Secretary of State for Transport is incredibly clear as well. We welcome the ambition and dedication of members of this Committee, and I genuinely mean that.

I would like to take the time to thank you, Chair, and your members for the work that you have done to support transport, not least smart motorways. I know of the work you have recently done on road pricing. It is incredibly important and valued by my Department. We welcome the ambition and the challenge, and I look forward to coming back at a further session to update you on the significant progress that I am confident we will have made.

Chair: Excellent. That is a very good way for us to close. Minister and Caroline, thank you so much. You have given us a heck of a lot of your time. We now look forward to writing up our recommendations and sending them over to you. Thank you again.