HOUSE OF COMMONS

Transport Committee

Oral evidence: Trains fit for the future?, HC 876

Wednesday 11 November 2020

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Watch the meeting

Members present: Huw Merriman (Chair); Lilian Greenwood; Simon Jupp; Robert Largan; Chris Loder; Karl McCartney; Gavin Newlands; Greg Smith; Sam Tarry.

Questions 1 - 83

Witnesses

I: David Clarke, Technical Director, Railway Industry Association; Mary Grant, Chief Executive Officer, Porterbrook; and Leo Murray, Innovation and Communications Director, Riding Sunbeams.

II: Mark Gaynor, Head of Railway Strategy, Rail Delivery Group; Paul Smart; and Chris Smith, Managing Director, G-Volution.

Written evidence from witnesses:

- Railway Industry Association (TFF0031)
- Porterbrook (TFU0001)
- Rail Delivery Group (TFF0021)
- G-Volution (TFU0002)

Examination of witnesses

Witnesses: David Clarke, Mary Grant and Leo Murray.

Q1 **Chair:** This is the Transport Select Committee's first evidence session in our new inquiry "Trains fit for the future". I welcome our first panel and ask them to introduce themselves.

David Clarke: My name is David Clarke. I am the technical director at the Railway Industry Association, which is the trade association for the railway supply chain, both infrastructure and rolling stock. Thank you for the opportunity to speak to the Committee this morning.

Mary Grant: My name is Mary Grant. I am the chief executive officer at Porterbrook, which is an asset owner and manager of almost a third of the UK rolling stock. It has been part of the industry for over 25 years.

Leo Murray: I am Leo Murray. I am a co-founder and director of innovation at the green tech start-up Riding Sunbeams, which has a corporate mission to power the UK's railways directly with solar PV.

Q2 **Chair:** Good morning, David, Mary and Leo. Thank you for being with us. This inquiry is going to look at the decarbonisation of the railway and how the engineering will look in the future, not just the capability of moving the trains but how the passenger experience will change. We are very keen to get all of your evidence.

It appears from your evidence that each of you is approaching the rail decarbonisation challenge in slightly different ways and focusing on different technologies. Could I ask you to set out what actions your organisations are taking in order to decarbonise rail?

Mary Grant: Recognising that long term, strategically, a greater level of electrification as set out in the decarbonisation network strategy is fundamental, in the short and medium term there are many things we are doing. We are already carrying out research, development and integration in the areas of hybridisation.

What does that mean? It is hybrid technology in battery power and hydrogen power. It is looking at where we can reduce today any emissions from the necessary requirement of diesel trains, which still have a very important role to play in the network, until we can see further electrification throughout the length and breadth of the UK rail network. There are many things that we are not just talking about but are starting to see that we can bring into passenger service over the coming years to support the challenge that we have all been set.

David Clarke: We obviously have not heard from Leo yet, but I suspect that all three approaches are probably very complementary. From our perspective, since 2017 we have been trying to get electrification and decarbonisation back on to the agenda. At that point, there was cancellation of a number of electrification projects, which, while

understandable because of some of the problems with particular projects, we felt was the wrong answer long term on decarbonisation. We have been calling for electrification to be recognised as the first choice for decarbonisation of the railway. You would look at that where you have freight, speed or volume. The kind of solutions that Mary was talking about have a massive role to play in places where electrification is not the right answer, and in the transition, as Mary highlighted.

We have been working across the industry. We have been involved with the decarbonisation taskforce and, more recently, the snappily titled traction decarbonisation network strategy that Network Rail has been leading on. That leads us to a point where, as an industry, we have a map that is starting to show what we would need to do to decarbonise the network.

The issue now is that we have the last of the live electrification delivery projects. Midland main line to Corby is just ending. We could end up in the ridiculous situation where we are losing capability when we know that we are going to need it in a few years' time. Our call is for a rolling programme of electrification, which this Committee has previously called for, supported by fleet orders of low-carbon rolling stock.

We need to get on with it for two reasons. One, as I have previously alluded to, is that we risk losing capability that we are going to need in a few years. The other is decarbonisation. If you save a tonne of carbon in 2020, that is 30 tonnes saved by 2050. That is our viewpoint.

Q3 **Chair:** Thank you, David. We will move to Leo. Without wishing to over-complicate my question, do you feel that there is too much emphasis on electrification, whereas technologies that perhaps may shortly be ready will allow us to reduce our reliance on electrification, which, ultimately, is still a dirty provide?

Leo Murray: That is a good question, but I am afraid I do not. I have to say that I agree with David. Electrification absolutely sits at the top of the hierarchy for rail decarbonisation for reasons that I think we are going to get the opportunity to go into a bit when we speak about some of the key documents that have come out from the sector in the last couple of years.

If electrification is at the top of the hierarchy, underneath that there are still opportunities to decarbonise the supply of power to the traction system. Network Rail uses about 1% of all electricity in the UK to move trains. It is the biggest single electricity consumer. As we continue to electrify, the proportion will rise.

At the moment, most of the decarbonisation that has taken place in the UK has taken place in the power sector. We have made great progress and, as a consequence, the carbon intensity of the grid in the UK has fallen a great deal and is now 230 grams per kilowatt hour. It is still true

that a technology like solar PV in the UK is well under 50. It is never more than 50, so it is about a fifth of the emissions.

Riding Sunbeams is seeking to substitute some of the power that was being drawn from the grid for direct supply from decentralised generators. They are a very good fit for the railways for lots of different reasons, not least that there is all that demand from the railways for power and it is distributed across thousands of miles of track. That fits very well with a decentralised generation centre or geolight solar PV, which you can effectively put anywhere. They are a very good fit for that reason.

I am not from the rail sector. Effectively, I have come at this from the renewable energy sector, trying to find somewhere to connect new solar farms to the grid in the UK, which has become extremely difficult to do. Grid capacity constraints and thermal and voltage constraints are rife across the country. The grid charging regime is not suited to bringing forward renewable generators. That is one of the reasons why decentralised technologies like solar and wind have stalled in the UK in the last few years. The railways represent an alternative route to market for that power, so it is a way to circumvent grid capacity constraints. Forget the grid and just feed straight into the traction system. You can do that almost anywhere on the network, on DC or AC lines.

It is also the case that the railway is the right kind of end user. What we have been told by the Government over the last few years with respect to renewables is that they need to stand on their own two feet. It is true that the costs of a technology like solar have fallen so far and so fast that we are very confident, from our work, that we can supply power to the railways at a lower unit price than power supply from the grid. We can supply it directly from a solar generator. The International Energy Agency recently confirmed that solar is now the cheapest source of energy in history, and that is only going in one direction. What we are talking about is lower cost and much lower carbon power direct to the railways.

Chair: I will stop you there, Leo, because we are going to drill further into the detail.

Q4 **Robert Largan:** Good morning to the panel. David, last March, the RIA published the "Electrification Cost Challenge" report. Can you tell me what the Department for Transport response to that report has been? What progress, if any, has been made to implement the recommendations in that report?

David Clarke: For the benefit of the wider Committee, the report examined a number of projects that had been delivered in the previous five years. It identified that 75% of those projects had been delivered efficiently in terms of cost and time. The remaining 25% were the well-known problem projects. The other thing the report did was identify lessons that could be learnt from both the problem projects and the successful projects. We made a load of recommendations about how we

could make sure that 100% of electrification projects were efficiently delivered in the future.

To answer your question about the DfT, they examined it quite closely. I have had a number of discussions with officials, who have been challenging in terms of, "Are those efficiencies actually being delivered on the ground in current projects?" We have worked with Network Rail to demonstrate that that is indeed the case. Most recently, as part of the transport decarbonisation network strategy, we ran a market-sounding exercise that DfT was keen to see happen. We put a questionnaire out to both infrastructure and rolling stock suppliers asking, "Are you ready for the potential decarbonisation activity, and can you demonstrate that you have the capacity and can deliver efficiently?"

The answer was a resounding, "Yes, providing we get a clear strategy that we are confident is going to be funded. Then the industry will swing in and invest in the people, plant and process that is needed." That has recently gone to DfT. My challenge to DfT now is to take all that on board and, hopefully, through the transport decarbonisation plan, which we understand will emerge in the new year, get behind it and give the industry a strategy we can work against.

Q5 **Robert Largan:** Thank you, David. I am a big supporter of electrification, but to play devil's advocate for a moment, given the very high cost and sometimes failure of previous electrification projects—we all know about the problems with the Great Western line—why should the Treasury trust the findings that electrification can be delivered for a 33% lower cost than in earlier projects? What is the comfort we have that those projections are accurate?

David Clarke: The comfort for that is that the recently completed projects—the last phase of Great Western from Bristol to Cardiff and the Midland main line—have been delivered in that cost range. Recent estimates that Network Rail are doing for potential projects in the future, like the balance of Midland main line and TransPennine, are coming out in that cost range. Scotland has been consistently delivering in that cost range after they had a blip with EGIP, Edinburgh to Glasgow. They learnt their lessons from that and applied the lessons.

I am very confident. We are not looking to the future and saying, "If we do a million things and cross our fingers, we'll be able to deliver efficiently." I am looking backwards at projects that have been delivered efficiently. Against that, we have the problem, to put it mildly, that was Great Western. The issue with Great Western was that, as an industry, we rushed into doing a big project, not just one big project but 10 all at once. If you have not done something for 20 years, which was the case, you are likely to be a bit out of practice. It did not go well. We need not to repeat that, which is why we are calling for a ramping up, starting now, towards higher volumes, rather than a sudden leap to huge volumes, which, as we know from past experience, is not wise.

Q6 **Robert Largan:** Let's hope the DfT is listening. My other question is more technical. In your answer to the opening question from Huw, you said that for some lines electrification is not the answer and is not possible. It would be useful to understand, from a more technical standpoint, what it is that means that electrification is not suitable on certain lines. What are the challenges that make it not possible?

David Clarke: Technically, electrification is suitable for any line. The issue is cost. You would apply electrification where the costs can be outweighed by the fact that you are running freight, which needs the energy that electrification can provide. At the moment, we have a challenge with freight, which I think you will hear more about from the next panel; other solutions do not have the energy density to haul a freight train. If you have freight, high speed and intense railways like commuter railways, electrification is the only answer if you cannot use diesel.

That leaves a fair bit of the network where those things do not apply—the less intensively used parts of the passenger network. There, although electrification would be a perfectly valid technical solution, it would not be a sensible economic solution. Those are the places where you would not put the wires up and you would look to use other technologies, be it battery or hydrogen or, in the short term, a number of options to make diesel more efficient. There are a number of things we could do to convert existing rolling stock to give it a life extension to help us manage the transition. Going back to the point I made earlier, the more carbon we save early, the better. A tonne now is 30 tonnes over the next 30 years.

Robert Largan: Thank you, David. Those are really helpful answers.

Q7 **Chair:** Mary, perhaps I could bring you in on this point. Robert and I touched on it with Leo and David. If we accept that there is some capability where you need electrification, and there is other capability where hydrogen or battery could get it right, is there a danger that we put everything into electrification now, when in fact just around the corner could be cleaner and cheaper alternatives that we then lose? Do you have a view on that?

Mary Grant: I would suggest that the consideration at present of the 11,700 single-track kilometres of proposed electrification is still being validated. There still remain about 2,300 where it is unclear what the most viable solution is, to respond to David's points about cost and benefit.

What we have ahead of us right now—this is what we are doing at Porterbrook—is assessing the viability to support a core electrified route in hydrogen, hybrid and battery. We have a responsibility to recognise that to get the best value from the asset over its entire life spans across a 30-year period. We have to assess now that we can ensure that those assets stay relevant to support the network.

What we are doing now is demonstrating alternatives. While the traction decarbonisation strategy group is validating the kilometres of track that should be upgraded to support the future of railway, we can demonstrate the blended supporting solutions that can give infill and support discontinuous electrification. You could have a part-electrified route that could then go on to hydrogen or battery. Those are the technologies that we are developing as part of our fleet portfolio R&D, working with our university partners at Birmingham, as well as other supply chain partners, to make sure that we are ready to respond to the Government's needs now and not five, six or seven years down the road.

Of course, the whole TDNS strategy spans a 30-year-plus trajectory. There are many things that we can be doing now, which we are, even reducing air quality[1] by exhaust after-treatment on older, near life-expired diesel trains that still have a very important part to play on the network today. That journey is starting now. It is a responsible one that we should all be taking and considering.

Chair: Thank you very much indeed, Mary. We will start drilling into the rail industry decarbonisation taskforce report. What a terrible title.

Q8 **Greg Smith:** Good morning, everyone. There is nothing so unclear as a state-sponsored report in the way that they word the title. On the rail industry decarbonisation taskforce, you will all be aware that the final report was published before the last general election, in July 2019, and had five key areas of recommendation.

As a starter, before we go into the detail, could I ask you all for your view 16 months after the report was published? How satisfied are you that there has been any progress on it? Where do you think the key progress has been? On the other side of the coin, what is still lacking 16 months from the publication of that report?

Mary Grant: For the first time, we are starting to see a potential road map for the 30-year strategy. That is pleasing; when you are looking at procuring assets and rolling stock, you need to take a long-term view because they have a long-term life value. There has been a clarity that we have not seen much before. The ask now is for that to come to a firmer commitment, so that we can take the right level of decision making to support the infill requirements, while an electrified roll-out does or does not materialise to the degree that is currently proposed to support the 2040 and 2035 targets set in England and Scotland, respectively.

Q9 **Greg Smith:** David, do you have some thoughts on that?

David Clarke: I have to declare an interest. I was a member of the taskforce. The taskforce was actually an industry group that was put together to respond to the challenge of the then Rail Minister to eliminate

[1] air quality emissions

diesel-only trains by 2040. We investigated and wrote a report, and offered it to Government.

The main conclusion, which perhaps had been in doubt up to that point, was that it was possible to decarbonise by 2040. In terms of progress, one of our main recommendations was that that would then need to be turned into a strategy. That is what the TDNS has done. It would have been great if it could have been done quicker, but quite a bit of work was involved.

The thing that could have been done, which has not been done, and we were calling for, is that there were electrification projects that are so-called "no regrets" projects, where it is fairly obvious that in any scenario you would electrify them in the long term. Decisions could have been made about them in the meantime. As they have not been, it would be great to see decisions being made about those very soon.

The other thing that has happened in that timeframe is that Mary's business and other businesses have been busy demonstrating that low-carbon rolling stock is feasible. Leo has been demonstrating that there are direct-wire solutions for renewable energy. We have not been standing still. In the last 18 months, certainly around low-carbon rolling stock and things like direct-wire renewables, we have moved forward and demonstrated that what was a theory is now practical, and you could actually start ordering it. That is what we would like to see.

In the normal course of events, railway funding comes in five-year cycles. The next cycle is 2024. The real challenge is that we should not wait until 2024 to start getting on with this.

Q10 **Greg Smith:** That is helpful. Before we dig a little deeper, do you have anything to say, Leo?

Leo Murray: The decarbonisation taskforce report said that we need to turn it into a strategy, and now we have the traction decarbonisation network strategy. My only gripe with how one led to the other is that the decarbonisation taskforce report highlighted the fact that, because of the advent of on-board battery storage on rolling stock, it is now possible "to assess electrification across a range of options rather than just a binary yes/no decision," so it is intermittent, discrete electrification. It is a much lower cost option and it is not really explored in the traction decarbonisation network strategy. It does not feature there. It was explicitly excluded for reasons I do not completely understand. To be perfectly frank, our view at Riding Sunbeams is that intermittent electrification is quite likely to be a better option, ultimately, for some of the routes that have been identified for hydrogen.

The last point on that is our concern at Riding Sunbeams about hydrogen. Green hydrogen is still a hypothetical at this point. Existing hydrogen feedstocks come from steam methane reformation, and even if you do electrolysis from grid supply power in the UK, you do not get any carbon

saving on a diesel hybrid. There is no carbon saving from hydrogen. There is an enormous amount of uncertainty around the future capability of hydrogen to deliver substantial emissions reductions.

We are sceptical about its role. Meanwhile, intermittent electrification, which is potentially an alternative option for some of the routes that are difficult to treat with full electrification, does not seem to have been given the time we would have liked to see.

Q11 **Greg Smith:** That is interesting. Can I potentially become a little bit awkward and challenge some of the presumptions? I always think back to a shift to a different mode of transport: road and private cars. If we go back 20 years the Blair/Brown Government told everyone to go and buy a diesel car. The European Union told everyone to go and buy a diesel car. Everyone thought diesel was the environmentally preferred fuel to put in a private car. Of course, that turned out to be absolute nonsense from an environmental perspective, and everybody is now trying to get rid of diesel, or the older technology of diesel as it was.

It worries me when we look at strategies, taskforces and plans that go over multiple decades. How sure can we be that electrification is actually going to deliver long-term carbon savings, getting to net zero or even some sort of technology that reverses the trend? How certain can we be that we have actually got it right and that we are not just grabbing the technology of today at the cost of technology tomorrow? You say that green hydrogen is hypothetical, but scientists are pretty good at what they do, and hypothetical technology has often become real technology and sometimes quicker than anyone expects.

Perhaps you could reflect on those thoughts. To throw into that a real-life example of something that is supposedly being done in the name of decarbonisation, or certainly some of the business case is in the name of decarbonisation—I do not agree with that presumption—it is of course the railway that the Government are building at the moment in the form of HS2. If you look at the whole life cycle of HS2 and some of the data, from the construction to the operation of that railway, it is still going to be a carbon contributor in 120 years' time.

When we are looking at these projects, how can we be certain that we are getting them right now? How can we be certain that rather than just looking at the while the wheels are turning element, we are looking at the whole life cycle of construction, operation and replacement of rolling stock into the future?

Leo Murray: Where to begin? Let's park HS2. I am familiar with the figures you have cited. They are certainly contested, but I do not think this session is about HS2.

I am a huge fan of technology innovation. That is my role here at Riding Sunbeams and in my other work at our parent charity, Possible. The problem is that decisions need to be made today, but because of the very long time horizons around investment in the rail sector—a train will be on

the tracks for 30 or 35 years—and because of the pressing need to decarbonise, unfortunately, we need to pick winners at this point. Electrification is known technology. You ask how confident we can be. We can be absolutely confident that electrification, plus the kind of thing that we do at Riding Sunbeams, will certainly deliver emissions reductions at the scale and speed required by the Climate Change Act. We cannot be confident that that is true for hydrogen.

Where the uncertainty comes in is around cost. I take your point. There may be some unexpected leap in technology that makes it look like we made a bad decision back in the early 2020s to do all this electrification, but it is not obvious on the horizon—in the horizon scanning and the work that has been done in the industry. My major complaint about the flagging of uncertainty about battery costs and hydrogen costs in both documents is that actually battery costs are quite well known and understood. At global scale production, they are falling on an experience curve. They are certainly going to continue to fall. The level of uncertainty for hydrogen versus the level of uncertainty for batteries is not comparable. Batteries are known. It is not a fully mature technology sector yet, but we can see the trajectory and it is visible.

That is all I will say about it. We have to make decisions now, and we should choose the things we actually know will work.

David Clarke: The beauty of electrification is that it can do anything you need to do on the railway. As I said before, it can haul freight trains and high-speed trains, and it is ideal for intensively used networks. The beauty of it is that you do not have to carry your power around with you. For hydrogen and battery, you have to carry your power around with you. That takes up quite a lot of space, which means that hydrogen and battery, even if there are the most ambitious levels of improvement in energy density, and indeed cost, are highly unlikely to be able to do those duty cycles.

If we are setting out a 30-year programme, and we crack on for the first 15 or 20 years electrifying the core bits of the network and rolling out low-carbon rolling stock, we will know a lot more about the technology when we are deciding about the last 10 years. I could entirely see that there would be more hydrogen and battery in the last 10 years displacing some electrification, but it is not going to displace electrification in its entirety.

Q12 **Greg Smith:** That is very helpful. I know Leo wanted to park the point about HS2. I did not raise it just because it is a particular hobby-horse of mine in my opposition to it. We are looking at long-term decarbonisation plans and the rail industry, and HS2 is undoubtedly the biggest railway project being built in the United Kingdom today. I accept that different parties contest the data around it to various degrees, but even HS2 Ltd's own documents show that it will still be a carbon contributor after 120 years.

How can we take seriously targets of 2040 and net zero by 2050 when we are building railways that are going to be carbon contributors? How do we ensure that construction phases, maintenance phases and rolling stock changes are included in carbon targets and in assessments of how we are actually doing and delivering on decarbonisation?

Chair: Could we have brief answers, please?

David Clarke: What is not in HS2's calculations is the modal shift that HS2 can drive. It releases huge capacity, for example, on the west coast main line, which we can use to run additional freight and local passenger trains. That will drive modal shift, and potentially take traffic off the road. That piece is not in their calculations, and it should be. I agree that we have to do a lot more in looking at major projects in terms of embedded carbon. Part of that is making sure that you use assets like trains for the whole of their life.

Q13 **Greg Smith:** Mary, what are your thoughts?

Mary Grant: You are quite right to ask how we can be sure. My thoughts from a rolling stock perspective are that we need to set out and specify the parameters. When any new rolling stock is built, how is the carbon being created? For example, a typical vehicle today will create the equivalent of 146 tonnes of CO_2. Its in-year maintenance, to put it into context, is about 2.3 tonnes. A very large quantum of carbon is created when that product is produced. As David said, it is a 30 or 35-year asset.

It is also about the materials. It is about the whole supply chain from a sustainable perspective. It is about how the product is used throughout its entire cycle. We should be putting down the parameters of what a very responsible environmental footprint looks like both currently, to improve the environment, and in building new going forward, to give certainties that it is not just a box that has been ticked on further electrification. The whole life of manufacturing, construction or any part of it is also being responsible to support the carbon targets that we are all being challenged to meet.

Chair: We now turn to Network Rail's traction decarbonisation network strategy. There is the opportunity, which you touched on, of 15,400 single-track kilometres that have not been electrified and what the choice will be for those over the coming decades.

Q14 **Gavin Newlands:** Some of the issues have been raised already, in question 1 and subsequent questions. The strategy recognises the huge importance of electrification, and that we should electrify the vast majority of the network, but it has been under-delivering in terms of single-track kilometres on an annual basis. It recognises that hydrogen and battery have their roles to play. Do you accept the findings in the strategy about how electric, hydrogen and battery should be deployed across the network?

Mary Grant: The short answer is yes. Obviously, the devil is in the detail, but we certainly welcome the quantum. It is 11,700 electric vis-à-

vis 900 of hydrogen and 400 of battery; 2,300 is still unclear. It is around the parameters as to whether that is the absolute right blend. Of course, it will be about prioritisation for routes that need electrification or alternative support, and in what control period. That is what I am particularly interested to see in the next stage of commitment—the where and when—so that we can plan and create the best quantum and output to the customer, passenger and taxpayer.

Leo Murray: In the main, I had chills reading that document. It is very exciting. It basically recommends 13,000 more single-track kilometres of electrification and that is double what we have today. It is very exciting.

I have already said that I am sceptical about the role that is envisaged for hydrogen. I am persuadable about it, but my main issue with the work that has been done is that what has not been looked at for those lines is an option around intermittent electrification, where you have onboard battery storage and bi-mode trains. Batteries and electrification are synergistic technologies. They work absolutely hand in glove, whereas hydrogen is a completely separate and distinct traction pathway for rolling stock.

My instinct certainly would be to favour batteries, where possible. The principal advantage that hydrogen has over batteries is range; there is not much speed advantage. Battery trains can charge on the move, running under the wires. Just putting overhead line on some short sections of the routes that are currently being earmarked for hydrogen trains has not been assessed. I would want to see that assessment, comparing those options, before conceding that hydrogen is the right thing to do; otherwise, it is very exciting.

I do not know if you have looked at the economic assessment. Pathway 4 is a 2040 net zero goal. It gets us there fastest and it also represents the best value for money. That is because, as David stressed, if you front-load the emission cuts now, they are cumulative over time, so the value of doing it is better.

Q15 **Gavin Newlands:** Thank you. I am conscious of the time, but could you answer, David? Then I have a quick follow-up question.

David Clarke: I support the conclusions of the TDNS. What is especially important is that it is starting to draw out a plan. Once that is converted into a funded plan that industry can plan against, it will be really important. As I said before, with the 2030 to 2040 timeframe for the plan, if we review the plan every 10 years, we can take on board emerging technology.

There are a couple of other quick points. The reason there is a lot of electrification in that programme compared with what some might have expected is freight. We need to run freight trains, and that drives a higher level of electrification.

This is a fantastic thing for the industry and for the country. If we employ an apprentice tomorrow to start doing electrification or low-carbon rolling stock, they will have 30 years of work in front of them. That is a good thing.

Q16 **Gavin Newlands:** David, you mentioned the cancellation of a number of electrification projects in England and Wales. Why do you think that so many have been cancelled? Why do you think there is a difference in approach, or certainly a difference in the decision-making process, when it comes to electrification projects in Scotland versus England? I am not looking to make a political point, because we all want to see the tracks electrified. I am just curious as to what the difference is.

David Clarke: Essentially, the difference is that some of the projects in England and Wales had gone badly wrong and the Government lost confidence in the industry's ability to deliver, so they curtailed the projects until the industry could demonstrate that we could deliver efficiently. The "Electrification Cost Challenge" report that we did demonstrated that, when you included analysis of what was going on in Scotland, 75% of the projects were being delivered efficiently. Frankly, Scotland had one problem project—the Edinburgh to Glasgow improvement project—and the team in Scotland learnt their lessons quickly and applied them even more quickly, so subsequent projects were delivered efficiently. We are taking the lessons from Scotland and applying them throughout the UK to deliver efficiently. As I mentioned earlier, recent projects have delivered efficiently.

Q17 **Gavin Newlands:** Mary, do you concur? Is there anything you would like to add?

Mary Grant: I support David, but I think we should be ambitious with the development of hydrogen. If we are looking at renewable and green energy in the future, which we should be considering—not fossil fuels; I agree with Leo on that—there is a role for it. For example, we are developing our hydrogen train. It is main line testing now. That is an electric/hydrogen proposition. There are solutions that can support the core electrification networks, but we must embrace hydrogen, because it also creates a renewable industry that as an economy has an opportunity for us, with skills, jobs and support longer term over the next 30 years. That is why we are doing that type of technology and R&D with the University of Birmingham now.

Q18 **Lilian Greenwood:** Good morning, David, Mary and Leo. I will try not to take too long. The first question is about the role that hydrogen could play. Mary, you are developing the hydrogen train. We have heard, and we know, that at the moment hydrogen cannot power trains to 125 mph. It cannot haul freight. It is not so good for intensively used lines where you need fast acceleration. Could hydrogen ever do those things? Is it about economics or about physics? What is the answer?

Mary Grant: Lilian, it would probably be good if I had Helen with me right now, but I don't. She is listening. It is a combination of both. The important thing with hydrogen is that it is in a developmental space for us, using it in heavy rail in the UK, but we need a whole economy, a whole infrastructure economy, around delivering hydrogen. We have had the announcement of the Tees Valley hydrogen hub that will bring business, R&D and the supply chain together to learn how to incorporate that within a network.

At the moment, we are developing rafts that go underneath the train, to be able to do a duty cycle up to, say, 75 mph. That would not support key arterial main route services or freight, but it could still support more regional routes. It is then about being able to bring in highly pressurised refuelling systems, because of the low density of the fuel. That is a whole infrastructure that we are creating, learning from and working with. It is not just developing a train where we can say, "Right, that can go into passenger service," because in isolation it cannot. We need capability for bringing green hydrogen, storing it and then refuelling in the whole system to make it work.

I think we can bring it. We should be ambitious, and we should be considering where it is right in different parts of the country. The TDNS report identified where that might fit in the north of Scotland or over in east Anglia or parts of north-east England.

Q19 **Lilian Greenwood:** At the moment, 58% of passenger trains and 96% of freight trains in the UK are powered by diesel. That compares with 26% and 44% in Europe. We lag behind China, Japan and India. What can we learn from other countries' approaches? Is there anything interesting happening in other places internationally? I do not know who is best placed to answer. Leo, is that something you can pick up?

Leo Murray: I will have a go. David is probably best placed, but we all know the answer, Lilian, which is a rolling programme. The fundamental reason why we have had such fluctuating costs for electrification in the UK is the feast or famine approach, which is not in the gift of the rail industry. They are decisions made by Government. A lot has been put on the rail industry for failing to deliver projects at cost, but the lesson from the countries you cite, which are further down this track, is that you have to have a rolling programme because intrinsically it reduces costs through experience curves. David might want to say something more.

Q20 **Lilian Greenwood:** I will come to David last because I have another question. Obviously, I entirely agree about a rolling programme.

David, in answer to an earlier question you mentioned no regrets projects— things that you should do and get on with. Can you just explain what those are?

David Clarke: They are projects where the characteristics of the railway are typically high speed and intensively used for passenger or freight and are not currently electrified. It is not hard to identify them. In fact, quite

a lot of them are shovel ready, as the term is. There are projects, for example, at the north end of the midland main line and on TransPennine, that are well developed in terms of design, and ready to go into delivery.

My approach, first of all, would be to progress with those, to contract to deliver the projects that are ready to be delivered and, at the same time, commission the design of the next tranche of projects that are obviously on the map. We can now go to the TDNS and find the map of the bits that you would electrify. Thirdly, I would start to procure fleets of low-carbon rolling stock to help us get an immediate carbon benefit. Lastly, I would look to Government to enshrine the TDNS, or at least the first 15 or 20 years of it, as a firm plan against which we can all invest.

If we do that, as Leo rightly said, we will have a rolling programme. Some of you will have seen this graph before. We have a graph that looks at the mountain range that is the feast and famine of UK electrification, with a 20-year gap between east coast and CP5. If you compare that with Germany, they have been shelling out 200 km a year every year for 50 years. Guess who is the most efficient at delivering electrification? It isn't us.

Q21 **Lilian Greenwood:** I am conscious that something like midland main line is drawing to a close in terms of the part that is committed. How quickly would you need to make a decision to, for example, extend electrification on that or other projects in order not to lose the staff teams who have developed the expertise? How quickly do we need a decision from Government to get the programme going?

David Clarke: Yesterday would be good.

Chair: We have 10 minutes left, and we are only just over halfway through where we wanted to be. Can I ask for quick questions and answers? We are going to go on to the challenges in deploying alternative technologies in the UK. I will hand over to Chris Loder, but he wants to come back in on the last section as well.

Q22 **Chris Loder:** I want to ask the three witnesses this to start with. On Network Rail's TDNS, I wondered if you thought it was Network Rail feathering its own nest. For me, it looks as though it is looking to preclude some of these great innovations and opportunities, particularly from a single-line point of view where it will almost blow enhancement business cases out of the water for redoubling in the future. I wondered if you had a view as to whether or not that was the case for the TDNS.

Mary Grant: No, Chris, I do not believe so. I think they recognise where there are routes that are unsuitable for long-distance high speed, which of course battery and hydrogen technologies are. We still have to consider freight and freight requirements.

I think they are taking the most sensible approach and looking at the main key arterial routes, looking at speed, looking at gradients and looking at what that rolling programme should look like. I think there

should be some further variations at the periphery. That is why we need to be ready to support and bring in the technologies, as we have discussed already. I think in the main it is very sensible.

Q23 **Chris Loder:** Leo, could I ask you next?

Leo Murray: I feel that is a bit of an unfair characterisation. They have done what they were asked to do—

Q24 **Chris Loder:** I am just asking a question.

Leo Murray: I think it is an almost comprehensive look across the different options that are available for meeting the targets that they have been set.

Q25 **Chris Loder:** David, what do you think?

David Clarke: I agree with Mary and Leo. It has been a good and thorough process. One thing to be aware of is that it creates a UK-wide business case to do electrification. The individual projects then go down to the Network Rail regions to be developed in detail. It is at that level where I would expect them to be looking at the future, as you are describing. As you will appreciate, you do not want to ossify the existing network. You want to consider whether you need to increase capacity or make other investment, preferably before you put the wires up. It is the regions that will understand that and will want to make the case for any enhancements they might want to do prior to electrification.

Q26 **Chris Loder:** What do you think the real challenges are of bringing in alternatively fuelled rolling stock? This is a really important point for us to understand.

Mary Grant: The challenges are on long-term commitment. We have had to take a decision as a business, with the support of the organisation, to start developing through R&D and delivery now. We have spent over £10 million to date on looking at alternative technologies that have not been committed to any main route at the moment, but if we wait for that commitment we are going to be too slow and then there will be negativity. It is about confirmation that there is a commitment to alternative technologies and a timeline for achieving it.

Q27 **Chris Loder:** Would you be looking for Government to make that commitment, or another organisation?

Mary Grant: Government will need to make the commitment on the future requirements, whatever there is going to be post the ERMAs and the DAs, whatever the passenger service contracts are going to be. They will specify what they are looking for in terms of type of traction. As I said, the important thing is that we are getting on with it now, so that we can support the Government's and the Department's requirements.

Q28 **Chris Loder:** Leo, could I ask you the same question?

Leo Murray: Again, I stress the difference between alternative traction modes and hydrogen. The challenges of introducing battery trains are trivial relative to the challenges of introducing hydrogen rolling stock. You can seamlessly, as the TDNS said, integrate into existing electric trains; you can simply add batteries. Doing it with hydrogen, you have to have refuelling stations. A whole new set of infrastructure will be required to do it.

David Clarke: I agree with Mary. The challenge is the long-term commitment, and the clarity and consistency of the commitment. If that is clear and the industry has confidence in it, businesses like Mary's will go ahead and develop their plans and invest in new technology.

Q29 **Chris Loder:** Is there something the Government can do to support that?

David Clarke: The Government have a clear role in setting the framework. Then the industry will operate within that framework. It would be very helpful if we can get some clarity before too long about who makes the decisions on procuring rolling stock.

Q30 **Chris Loder:** Leo, I'm sorry, I didn't ask you about the point on Government support.

Leo Murray: Don't worry; we are running out of time.

Chair: Let's look a little more at the research and development funding, what has been available and what the opportunities are.

Q31 **Sam Tarry:** Good morning to you all. The Rail Safety and Standards Board—RSSB—has combined funding, with Network Rail, of about £100 million in an innovation fund; £80 million from the DfT and £20 million from Network Rail. There is also the option for the Government's innovation agency. In total, its funding in 2020 was about £9.4 million, which was made available. That was mainly in small grants of between £100,000 and £400,000.

My view, if I am really being honest about that, is that some of it is quite small beer. For the scale and uptick in terms of development and speed at which we need technology to be coming on stream to get anywhere near reaching some of the more ambitious targets, I feel we need a significant uptick in the investment from Government. We have someone here from Riding Sunbeams, which is an innovative project. The amount that those sorts of projects could be funding could be scaled up far more quickly and I think that is where the potential lies.

I was involved in the rail industry, like some other members of the Committee. In the grand scheme of things, when you look at the control periods for Network Rail and the scale of money that is coming in, this is an industry that costs a heck of a lot of money. That is not to say it is not good value, but it is something that is intense in terms of the amount of technology and the amount of money that needs to be spent on engineering design and planning over long periods of time. Could you comment on what you think the scale of funding should be to make these

technological changes happen more quickly? Over what sort of period of time would that need to happen?

Leo Murray: I agree. If we really mean to do this, we need to resource it properly. However, it would be churlish of me to complain, because Riding Sunbeams has been a great beneficiary of a number of different R&D funding streams. We have been funded by Innovate UK and the Department for Transport under First of a Kind. We have also been funded by RSSB to do feasibility studies. We are now in line for the Getting Building fund post Covid for building a pilot scheme.

I want to make a slightly different point about innovation and R&D. The rail sector is notoriously difficult to penetrate as a new market entrant. It is not a friendly environment for SMEs and innovators. It is very difficult to innovate in rail. That is not just about the funding that is available for doing it. It is also about the requirement to engage with a giant administrative bureaucracy that is structurally geared to maintaining the status quo as tightly as possible. It is a very heavily regulated sector, and that is right because there are critical safety regulations.

We have had phenomenal support. People we speak to in the sector about Riding Sunbeams are always astonished at the amount of progress that we have managed to make in the very short amount of time that we have been working on this. We have had incredible support from inside Network Rail. We are an SME, and it is over a year since we commissioned our demonstration scheme that shows that it is safe and efficient to supply solar directly to the DC traction networks. We had hoped by this point to be building out a scale demonstrator—a scale pilot project—a multi-megawatt solar farm of the type we are proposing to use to power the railways.

This is a market that does not exist at the moment. Network Rail buys all of its electricity at the moment via a single 10-year contract with a big energy supplier. What we are proposing is a completely different approach, where Network Rail starts to procure power directly from small-scale generators. I do not want to go on about this too long, but where we are now as a business is in the railway valley of death. We have done the technical innovation. We have overcome the hurdles and we have shown that it works, but despite all the support that we have had from engineers, asset managers, and the sustainability team on carbon and energy at Network Rail, Network Rail is effectively the client for traction power in the UK. They buy nearly all of it. There is TfL and Transport for Wales, who we are also speaking to, but if we are going to make this work it has to be with Network Rail. We are now going round in circles with the commercial team to get the pathfinder project built.

I am conscious that we are running out of time, but to illustrate the issue, there is an excessively risk-averse and conservative mindset around procurement. On the technical side, we had all the support we needed. There is a provision we have been pointed to by the Treasury agency, Local Partnerships, called an innovation partnership. It is public

procurement protocols. Network Rail could be using that to do a one-off single-supplier contract with us to get the thing built, but we are going round in circles. Network Rail says, "We have to do this via a competitive tender," but it will not issue a competitive tender if the contract framework is untested and the technical details are unclear. Until we have built a megawatt-scale solar farm, those things will remain unclear. We are in a "computer says no" situation, which, I hate to say it, is something I hear quite often from other people who have tried to innovate in rail.

Q32 **Sam Tarry:** That is really interesting. That drills down into some of the issues. I am familiar with some of the workings of Network Rail. Mary, could you pick up the wider point about whether you think the scale and current level of Government funding for R&D is enough to drive the level of innovation that is needed?

Mary Grant: That is a really difficult question to answer. The short answer is that I do not know what the absolute quantum should be. What I recognise, and what is important, is that the TDNS first framework of changing traction is recognised in the commitment of alternative technologies, and alternative technologies require R&D and commitment. At least, we are seeing something articulated over a 30-year period. We have not seen that before, or I have not seen that before.

We must recognise that although it is small beer—your point—Innovate UK is supporting hydrogen and after-treatment exhaust improvements with secured funding to date. It is relatively small. The commitment has to be that you choose the traction you want and the routes, and then make sure that the industry, the supply chain, academia and other partners can come together, and that it is supported by Government and the right amount of funds are allocated to deliver it.

Q33 **Sam Tarry:** Do you have any comments about rail freight? If we were to shift far more goods off motorways and on to rail, it has been demonstrated that over a long period of time that would be a significant shift in terms of decarbonisation. We have not spoken much about that, but do you have any comments on that particularly within this kind of discussion?

Mary Grant: Our freight partners today are looking at what their future traction should be, bearing in mind being able to get the length and breadth of the country to carry freight produce. I think there are a number of things we can do today to support what is currently diesel traction, because they need the power, the actual tonnage of what they are carrying. Diesel is their option today, without a fully electrified route. We can clean up those engines. There is a product called Eminox. It is an after-treatment. We are doing it on passenger services today. You can do that.

We are also looking at light logistics. You can use part electrification and part battery. I won't go back to hydrogen, or Leo will have another point

on that, but there are options that can support the decarbonisation challenge while we set out a road map that is as suitable for passenger as it is for freight.

Q34 **Sam Tarry:** David, can I turn to you lastly on the question about funding? If you have a point on freight, it would be helpful as well.

David Clarke: On the funding point, I am not going to discourage you from making the case for more innovation funding. As Leo says, I do not think that is the biggest issue. The biggest issue is the ability to get beyond the innovation funding into market, as Leo well described.

The role for Government and procuring agents like Network Rail is to create the right environment, where innovation can move from prototype to deployment. That is the real challenge. As Leo said, there are tools and techniques out there, with innovation partnerships being just one. It is much simpler if we think about rolling stock. We now have credible demonstrators. If there was just a normal commercial tender put out, the market would respond. We do not need to do more innovation. We have done that. Let's put some tenders out there.

Chair: Thank you. Greg was going to ask about the challenges for Leo of breaking into the rail industry, but you have given us a really clear answer on that, Leo. I am going to move to the final section. Lilian will take us through the franchising and rail industry reform opportunities.

Q35 **Lilian Greenwood:** We know, obviously, that the Government are reforming passenger service contractual arrangements, and at the moment moving to emergency measures recovery agreements or emergency recovery measures—I can't remember what they are called—the ERMAs. How should Government use those to incentivise the move to a carbon-free railway? Do the new arrangements help or hinder?

Mary Grant: I do not think they help or hinder. It is quite simple. Whatever we want to achieve, let's just set it out. Where you have an area that you can control directly, what can you do about it? Within the operating environment of a franchise or contract—whatever they are going to be called—how you reduce your carbon footprint, or offset it, is one part. In terms of the rolling assets, the things that we own and manage in conjunction with our customers, what can we do to demonstrate that the carbon is being reduced, not just for future procurement of rolling stock but now? We can demonstrate that. Let's set down some very clear targets and deliverables, and then hold us all to account to achieve those and demonstrate how we are doing it.

Q36 **Lilian Greenwood:** Do either David or Leo want to add anything on the way in which the contracts are run? Previously, under the franchise arrangements, sometimes things did not really change in terms of rolling stock until we got a franchise change. Is there anything that needs to be done, David?

David Clarke: If we have a national strategy in place, in terms of the TDNS, franchises should be expected to follow that and facilitate it. Whatever process we have for selecting the successors to franchises, they should bring forward their plans to meet those targets, and have very clear targets for their trajectory on carbon reduction, not just on traction but across the whole of the franchise that they are going to put in place.

It would be helpful to bring in initiatives that encourage. Mary mentioned a number of examples of what we can do to reduce carbon in today's diesels. There could be more measures to encourage that activity, as well as the introduction of a new generation of low-carbon trains.

Q37 **Lilian Greenwood:** Just build it into whatever form of contract you have. Is that right?

David Clarke: Yes. It should be part of day-to-day business, and the businesses should be measured against those trajectories.

Q38 **Lilian Greenwood:** The Government are due to publish the Williams review and the transport decarbonisation strategy; it may be before the end of the year but is more likely to be in the new year. What are the three most important things to support the decarbonisation of the network that ought to be in those reports? In the interests of time, I will ask you for one each, or maybe a maximum of two each.

Leo Murray: Expanding the rail network. It is very easy to lose sight of the fact that rail is a solution to transport decarbonisation more widely. The focus that we have had in this session and in all the documents surrounding this in the industry processes is around decarbonising the rail sector itself. Actually, modal shift from road and air to rail is an essential component of an economy-wide transport decarbonisation plan. It remains to be seen how forthright the transport decarbonisation plan is about the scale of modal shift that is required but, to get it into perspective, if we were able to shift 10% of HGV traffic from roads today to rail freight, the emission savings from that would be equivalent to all the emissions from the entire rail sector today.

In order to achieve modal shift, we have to increase network capacity. We need to expand the rail network. That is my No. 1 message. We should not always be on the back foot. Rail is a solution even at today's levels of emissions per passenger or per freight kilometre. It is a fraction of the—

Q39 **Lilian Greenwood:** Is it a target for modal shift because everything else will flow from it? Obviously, to make that happen requires quite a lot of action.

Leo Murray: Exactly, Lilian. That is what we have proposed in our submission to the transport decarbonisation plan. We need a target for an overall reduction in vehicle miles being driven on the UK's roads. It is really not clear that it is possible to meet our climate targets. EVs are

essential. We have to electrify the remaining road transport, but we also need fewer cars on the road. That would be a profound reversal of a 70-year-plus trend, so it is a very big deal. I wait with interest to see, frankly, how the transport decarbonisation plan is able to acknowledge that fact, but it is a fact.

Q40 **Lilian Greenwood:** That is one for the transport decarbonisation strategy. Mary, what would be top of your list for what should be in the Williams review or the plan?

Mary Grant: The guiding mind, wherever that sits. Let's just get on with it. We have 30-year strategies that we want to bring in for all the reasons we have discussed over the last hour-plus. We have to get on with enacting the things we know we should be doing to make real the genuine catalyst for the economic recovery and the future, bearing in mind that it is the clean green obvious mode of transport. Let's just get on with it because there is a lot to do.

Q41 **Lilian Greenwood:** David, is it going to be the rolling programme of electrification?

David Clarke: Yes. Obviously, the 30-year strategy is key, and a subset of that is a rolling programme of electrification and a plan for introducing low-carbon rolling stock.

Another thing I would look for is recognition that the supply chain is part of the solution. We have lots of ideas and capability, and we can invest, given the right environment. That would eliminate the boom and bust that has sometimes made our delivery inefficient. The converse is that, if we can eliminate boom and bust, we can be efficient. We can give you more railway for the same amount of money.

Chair: Thank you very much. That concludes our first session. David, thank you and the Rail Industry Association for your evidence. Mary, you mentioned that Helen was listening in. Our regards to Helen. Thank you very much for the evidence from Porterbrook. Leo, thank you. We were due to come and visit to see what you were doing, but the November restrictions have taken us out. We hope we can do that another time. Thanks to all of you. I wish you the very best at this time.

Examination of witnesses

Witnesses: Mark Gaynor, Paul Smart and Chris Smith.

Q42 **Chair:** We now move to our second panel. We will be hearing from rail operators, freight experts and fuel innovators. I will ask each of the panel members to introduce themselves.

Mark Gaynor: I am Mark Gaynor, head of railway strategy at the Rail Delivery Group, which represents train operators, Network Rail and HS2, but today I am here to represent passenger train operators. I am also a member of the rail industry decarbonisation taskforce.

Paul Smart: My name is Paul Smart. I was a long-term managing director of one of the freight operating companies, but I retired a couple of years ago. Now I represent the Rail Development Group's freight board and the freight operators in particular; DB Cargo, GB Railfreight, Freightliner, Direct Rail Services and Colas Rail. I, too, was a member of the decarbonisation taskforce.

Chris Smith: My name is Chris Smith. I am the managing director of G-Volution. Our mission is evolving towards the zero-carbon economy. Our aim is to see the current infrastructure diesel engines support cleaner and greener fuel while saving operators money.

Q43 **Chair:** Thanks to all three of you for being here with us this morning. Just before 11, I will suspend proceedings for the two-minute silence, and then we will come back to you.

I will ask a general question. Perhaps you could keep the answers brief because we will dig into the detail. Where do you believe the main focus should be for the Government and the rail industry in order to meet the challenge of decarbonising the rail network?

Mark Gaynor: There has already been a lot of good work, and I think your previous session touched on it, through the taskforce and the traction decarbonisation network strategy. What we need now is a clearer long-term plan that we can all align our efforts to. That needs to be supported by policies on a consistent long-term basis, as well as aligning rail reform to the need to decarbonise. I can talk about that later.

Paul Smart: There has been a lot of talk about electrification and comparisons with battery and hydrogen power. Many people have touched already on the strong requirement of the freight segment to have electric traction going forward. That needs to be brought to the fore. Other traction methods have some complementary roles, but very strong emphasis on supporting the TDNS is an essential way forward.

Q44 **Chair:** Chris, in answering the question, can you also tell the Committee a little bit about your innovative work on dual fuelling and the potential impact that would have?

Chris Smith: Happily, yes. I am sorry to say this, but the best way to see what we do is to spend two or three minutes watching a video on our website. It is much more eloquent than me.

Essentially, we take existing diesel engines, and our technology allows them to fuel on two fuels at the same time. We have two demonstrators out on the network in the next month or two. One will be running on diesel LNG and another, which has already run a little on Network Rail, will be running on diesel and bioLPG. Essentially, we take existing infrastructure, and demonstrate that the technology can use cleaner fuels. We believe that those are lower carbon. We focus more on defossilisation than decarbonisation in that sense. At the same time, we

can build an infrastructure around those cleaner fuels while providing a payback, which is central to our message.

In terms of the focus that you asked about in the main question, I want to make it very clear that we completely agree with all the ideas going into the future. What I cannot help but notice, having been involved in the industry for very few years—just five compared to many more eloquent people who have spoken—is that there is very little focus on what has already sunk into carbon-existing infrastructure and vehicles. There are 3,500 DMUs and I think—Paul will correct me—632 or a large number of freight vehicles that exist. Those have a long life, and some of them are still being bought.

In my view, the focus should certainly be on the long-term strategy, as we have discussed, and as your other witnesses said. What we also need to think about is what happens now. Everybody has made it very clear that we have to do something now. We have a technology that exists today and can support the infrastructure of tomorrow. We would love to see that as part of the opportunity.

Chair: Thank you all for the openers. We are going to look in a little more detail at each of the components. The first is the rail industry decarbonisation taskforce report.

Q45 **Greg Smith:** I do not know whether the witnesses from this panel—good morning to you all—listened to the previous session, but we had some interesting feedback on the rail industry decarbonisation taskforce report and where we are with it 16 months on. I would very much welcome your thoughts as to where progress is with the recommendations in the taskforce report and where you think the Government could be pushing forward faster.

Mark Gaynor: In terms of progress that has been made, the traction decarbonisation network strategy emerged from the recommendations that the taskforce made. That has been quite a comprehensive piece of work, with a lot of cross-industry engagement. At the end of it, we now have a high-level road map for how to decarbonise the rail network. That has been very positive.

In normal times, we would perhaps have expected to see more progress around some of the reform elements. We were expecting the Williams review to have come out by now with what it might say about industry restructuring incentives and policies to support decarbonisation. Clearly, that has not happened. Now everyone is waiting to see both what happens around rail reform and what the content of the transport decarbonisation plan is, and how far that will go in making commitments, providing funding and providing enabling policies to support the delivery of what the TDNS has quite sensibly set out as a long-term strategy.

Q46 **Greg Smith:** Paul, do you have any thoughts on that?

Paul Smart: I agree with what Mark has just said. From a freight perspective, the principal report of the taskforce got as far as concluding that freight is pretty challenging. It did not really get to a conclusion. Since that report was published, in the background there has been a research project undertaken by Ricardo, led by RSSB, with industry involvement. It delved into the next layer of what can be done for freight. It did not find a silver bullet, but it quantified some of the handicaps in payload and range that would perhaps pertain to battery and hydrogen traction. It concluded, as have many other reports, that electrification is the most robust route to achieving decarbonisation, but it delved into that next layer, looking for the silver bullet and quantifying the handicaps of the other modes.

That took quite a long time. Delving into how much energy a freight train uses getting from A to B took quite a bit of triangulation around various parameters so as to get that agreed and to get Ricardo to build their models from that. It reported in late summer or early autumn, so it is relatively fresh news.

Q47 **Greg Smith:** Christopher, do you have any points?

Chris Smith: My only point about the strategy is that it does not contain any reference to cleaner fuels. Strategies in other countries, such as Scotland, Spain, Italy and many other countries I could list, do. What Paul just said is absolutely right. There was a very good report written by Ricardo, and it specifically highlights natural gas as a potential immediate solution.

Without sounding repetitive, in the context of the strategy, natural gas exists today. It can incorporate hydrogen tomorrow, and it can be part of the infrastructure. If there is anything missing, in my view, it is a common-sense understanding of what exists today and what we can do about it today.

Q48 **Greg Smith:** In the earlier session, I asked witnesses to give their opinions on this. When we look at decarbonisation, particularly when we are setting 10, 20, 30 or 40-year strategies and plans, just as the Government 20 years ago, not just in this country but across the European Union, got it wrong on diesel cars, how can we be so sure, given the emphasis on electrification in a lot of these strategies, that that is the right way forward? While hydrogen is not quite there yet, you can see with some of the brilliant minds that are working on hydrogen and other fuels that those technologies might be there, and might be better within a not particularly considerable timeframe.

When strategies are being set, do you think there needs to be an ongoing challenge to presumptions made in them as technology develops, given that, just as all those Governments were telling people to buy diesel, they had no comprehension that within 10 or 15 years electric cars would be, not mainstream but certainly more normal on the roads than they are today? How do we apply that to rail?

Chris Smith: In my view, there are two critical points that you have just made. The first is that we already have an infrastructure. We already have all these vehicles out there. The Ricardo report that Paul mentioned refers to doing something about it. The issue may be, from a Government point of view as well, that it takes some money, but actually in this case it does not. The technology actually saves money. It has on average a three to five-year payback. That is the first thing. You have a whole load of vehicles and you could do something about it now. Why don't you do something about it now? For example, encourage it or support further innovation with it or whatever it might be.

The second thing is that the lifetime of a freight train—there are people who are more expert than me on this panel—can be 40 or 50 years, let alone 30. Therefore it is different from cars, in the sense that you can switch from diesel to petrol. I do not know the average age of a car, but it is a lot less than it is for a locomotive or a diesel multiple unit on the tracks. For me, those two things combine. It is simply looking more pragmatically at the situation that exists, both for saving money and using the infrastructure. We have already sunk carbon into all of these things.

You may well want a hydrogen train, but, as the HS2 commentary said earlier, a lot of carbon goes into building these things. They are already built. What we need to do is to show that you can bring in the technology now and save money now, while evolving an infrastructure for tomorrow. It could include hydrogen, and a lot of other fuels that are not taken into account like biogas, which is big in the trucking industry, and bioLPG, which is becoming quite large in shipping, as well as other biofuels of the future. I will shut up because it is 11 o'clock. It is for the Chair to say, but I think we are the point when we should be quiet.

Chair: We will come back to this. I will suspend for the two-minute silence.

The Committee observed a two-minute silence.

On resuming—

Chair: We return to our second panel. Greg, you were part way through.

Q49 **Greg Smith:** When we look at the decarbonisation taskforce report, or at any plans for the rail sector in particular to meet net zero by 2050, what are your views on whether anything that was in the taskforce report needs to be re-examined in light of the things we know because of the pandemic, the massive drop in rail use, and the fact that the railways have been nationalised in this window?

Secondly, to come back to some of the themes from the earlier session, how we do we ensure that, when we talk about long-term decarbonisation plans, we look at the whole life cycle, not just at the rolling stock, but of the entire construction phase where we build new railways? HS2 was the example I brought up earlier, but equally East

West Rail is being built as a fresh railway at the moment, as are others. How do we ensure that those projects look at their contribution to carbon over the long term? We know HS2 will still be a carbon contributor after 120 years. It is hardly a green project. How do we roll that into the recommendations and ensure that we get it right?

Mark Gaynor: I will start with your second point about managing carbon on a whole-system basis. The challenge is that, if you do not measure it, you cannot really manage it. Progress is being made. The rail industry has developed a carbon measurement tool to enable, for example, infrastructure projects to understand how much carbon they are likely to use in terms of materials—concrete, steel and so on—and to look at clever ways of designing that carbon out, through more efficient use of different materials. That sort of approach, which has been trialled and tested—Network Rail has used it on a number of projects—needs to become more widespread, so that we look not just at the operational carbon we have largely focused on, but at full life cycle carbon. That will allow those sorts of trade-offs to be made.

An interesting piece of industry research that RSSB is carrying out at the moment seems to indicate that, for the railway as a whole, embodied carbon is very significant. The carbon involved in renewal, maintenance and extension of lines is quite a significant amount. I suspect it is an area that we should look at as an industry in more detail.

On your first point about what is different now, the pandemic has had a major impact on passenger demand. We saw it bumping back up to about 40% of normal before the current restrictions came in, and it has fallen again. What was quite worrying as we emerged from the first lockdown was that car traffic and road traffic bounced back much more quickly than rail.

I looked at a study from the RAC this week that suggests that more people plan to drive as we emerge from the pandemic, and even if green transport alternatives are available, they may be reluctant to use them. We need to do everything we can to avoid a car/road traffic-led recovery. From the RDG perspective, fares reform is a really important tool in the arsenal that train operators have to encourage people to come back to rail, by offering them a more transparent, more flexible and easier to use fares system. If we do not do that, people will go back to using the car.

Q50 **Greg Smith:** That is very helpful. Paul, do you want to put your thoughts from the freight perspective?

Paul Smart: On the point about the dash to diesel cars 15 or so years ago and the regrettable post hoc impact, electrification has been done at scale before and we know there is not an adverse post hoc side-effect to electrification, so it might be slightly different from the case with diesel cars.

On embedded carbon and the comparisons to HS2, we as a freight community are unlikely to use HS2. The whole electrification argument does not entail completely rebuilding or building from scratch the infrastructure, but is a modest add-on to an existing infrastructure. The embedded carbon for the electrification that is contemplated is materially lower than the HS2 example.

Finally, in relation to the pandemic, one benefit, if you like, that freight has experienced during some of the suppression of certain passenger traffic is that the sector has been running some very long—770 metre—freight trains to the Manchester area, for instance. That demonstrates a route to less carbon per tonne even within the existing constraints of the network. I am by no means waving a flag for the pandemic, but that is something that has been demonstrated in the shadow of the pandemic as a route to energy improvement and, therefore, potentially carbon improvement for the future.

Q51 **Greg Smith:** Christopher, do you want briefly to comment on any of those factors—the pandemic and the long-term life cycle?

Chris Smith: On the pandemic, my main point would be that, if there is something falling into public hands, it would be good to look for cost-effective, immediately available solutions that can support strategy. The point you made earlier is that nobody necessarily knows what will work best going forward.

On HS2, I take the point you make. From our perspective, it is going to increase the demand for freight significantly. I have heard figures of between 10% and 20%. Were those freight locos to run on cleaner fuels, it would assist at least some of the sunk carbon you were talking about in the 120-year timeline.

Q52 **Lilian Greenwood:** The Network Rail traction decarbonisation network strategy, which we are all familiar with, calls for the majority of the rail network to be electrified, with the potential for battery and hydrogen at the edges, if I might say it like that. Do you think their findings about how those different potential solutions should be applied are right?

Paul Smart: In terms of core electrification relative to the constraints of many of the other traction modes that have been looked at—battery and hydrogen in particular—I see it as fairly imperative to driving decarbonisation of the rail freight sector. I do not rule out a contributory role for some of those technologies at the bookends—the top and tail—of a long trunk haul or bridging between parts of unelectrified networks. There is work to do there. In some instances, there is potentially even a case, which is covered in the Committee on Climate Change report, for retaining some diesel for bridging as the most cost-effective solution, with possible offset elsewhere in the economy. I strongly support the findings of the TDNS and have an open mind on the supports around the fringe.

Q53 **Lilian Greenwood:** Mark, do you have anything to add?

Mark Gaynor: In broad terms, I am supportive of the TDNS findings. What may change is that, if we get really good at doing electrification and get the cost down, perhaps that will enable us to expand the electrification network. We need to demonstrate that we can do that.

We must not look at the TDNS as just an infrastructure plan. We need to make sure that we end up with a plan that aligns infrastructure change to rolling stock introduction, to skills and to the supply chain, to make sure that it is a holistic whole-industry change programme, which is what it would need to be effective.

Q54 **Lilian Greenwood:** I may be straying into someone else's question if I ask whether the structural changes helped or hindered that. Christopher, I will come to you with the same questions about the traction decarbonisation network strategy. Are you supportive or are there things that they got wrong?

Chris Smith: Broadly, as I said at the beginning, I am supportive of all the changes that bring about decarbonisation. If there is one fundamental misassumption, it is not adopting cleaner existing fuels, such as biogas and bioLPG, which are prevalent in the shipping and trucking industries and in many other countries, partly because they exist today and can be burnt or combusted in a diesel engine and partly because they are part of building the infrastructure of tomorrow. For those reasons, there is a fundamental failure to address something that could be done now in the strategy. Having said that, I am all in favour of the other points that were raised.

Q55 **Lilian Greenwood:** My second question picks up something you were talking about, Mark. The Rail Industry Association has suggested that electrification projects can now be carried out a third cheaper than projects in the past. We all know about the problems with Great Western. Are you confident that they are right about more cost-effective electrification?

Mark Gaynor: The Railway Industry Association has done some good work to understand how to deliver electrification at a lower cost. There is some good evidence as well from some more recent projects that we can deliver cost-effectively here in the UK. A lot of it is around having a pipeline of projects, so that we are not trying to change the world in a year but do things steadily and efficiently, and ensure that we plan effectively, which was one of the big downfalls of the Great Western scheme. If we have a longer-term electrification programme, that is where the opportunities for doing things efficiently will come from. I am confident, based on what I have seen from the supply chain, that they are able to deliver much more effectively than perhaps was the case with some of the more notorious electrification schemes of the past.

Q56 **Lilian Greenwood:** Christopher and Paul, do you have anything to add on that point about efficient electrification?

Paul Smart: I agree with Mark and save you some time.

Chris Smith: I am sure it is right, from what I know, which is not enough to give you an authoritative answer. Whether it is right or wrong, whether it is cost-effective or not, it takes quite a long time to deliver. That is our point.

Q57 **Lilian Greenwood:** That is why there is a need for intermediate technologies while we are getting there.

Chris Smith: Immediately available, cost-effective transitional technologies will help to build that plan.

Chair: Chris, if you can speak a little closer, that would be ideal. We will talk about the challenges in deploying alternative technologies in the UK. We have touched on it, but I will hand over to Gavin Newlands to go into detail.

Q58 **Gavin Newlands:** The decarbonisation taskforce report recommended that research should be developed to increase the capabilities of battery and hydrogen. The DFT said that it does not see any specific barriers to the uptake of alternatively powered trains. That is a view challenged by the evidence. We have touched on one or two of them, but what do you consider the main challenges in deploying alternatively fuelled rolling stock and what can the Government do to help? Chris is champing at the bit.

Chris Smith: An hour isn't long enough. There are multiple challenges. I have tried to summarise them briefly in my notes. Essentially, when you bring clean fuels to the network, there is a very long-winded safety approval process that costs a fortune. If we had not had help from RSSB, it would have been totally unaffordable. It is somehow part of the transition that needs to be made for hydrogen. The question of the safety approval and then some sort of standard for cryogenic and other fuels is a major hurdle and a barrier to entry. Having said that, we have overcome it.

The infrastructure roll-out suffers from the same point. You have a number of places where you need to put clean fuels. It can be hydrogen, it can be natural gas and hydrogen, hythane or bioLPG. Whatever it is, the owner of the depot has to get approval from multiple people and do training and so on.

The overall ownership structure of the industry itself, between the ROSCOs, the TOCs, the infrastructure depots and training, are massive barriers to entry for anything new. From outside the rail industry, even having done a feasibility, I have been astonished by the difficulties. Leo put them more eloquently than I have. We both feel the sense that it is so difficult. That is without mentioning the barriers that you get for this kind of technology anyway, which is OEMs' reluctance to do anything other than what they do, and the reluctance of customers who could

benefit from taking on the technologies. I do not want to go on forever, but hopefully that is a summary of just how tricky it is.

Mark Gaynor: I have a few points. On reliability first of all, introducing new trains, even in the best of times, does not always go smoothly. There is ensuring that there is proper testing and validation before they enter into service. There may be challenges around higher initial capital costs for some of the new technologies. That may be offset through operational cost saving.

You need to take account of a whole-life approach. I know I have been banging on about the whole system in a number of answers. We cannot think about the rolling stock in isolation from everything that needs to go with it to make sure the trains work. Training drivers, making sure that you have maintenance staff who know how the new technology works, appropriate refuelling and recharging facilities, depots and stabling facilities all need to be thought about.

There is a different range of performance characteristics in going from a diesel train that can run anywhere and provide quite long services to something that may be more range constrained, or that may accelerate fast or not as fast. That all needs to be thought about in terms of the timetable and stopping patterns.

There is an important element about engaging with customers, to make sure that they understand the rationale for things that might be changing. Having a long-term plan and pipeline of investment would help to give the supply chain the confidence to invest in the technology, ensure that it is reliable, open up opportunities for UK suppliers and ensure that there is stronger engagement across all parts of the rail sector.

Paul Smart: Very specifically on the freight sector, freight operators are all private companies and will always be cautious about investing in a new technology that has not yet been proven on the network. You will be aware that rail freight is not exactly a licence to print money. It is a high-volume, low-margin business, and getting it fractionally wrong can be quite risky. That is a cause for caution on the way through this.

All the alternative technologies have an impact on power or range and erosion of payload. There is a fundamental economic upset to be catered for, which is a challenge going forward. There are an awful lot of individual locations around the UK, to and from which freight goes, to which future fuels and future charging technologies will need to be applied, relative to a modest number of diesel fuel points where a locomotive can fill up with fuel and go off for a few days' duty. Those represent some of the key challenges in applying alternative technologies in the freight segment specifically.

Q59 **Gavin Newlands:** Do you think the DfT is listening on the issue of the challenges and trying to address them?

Paul Smart: I certainly believe the message is being landed. In a word, yes. The RSSB research projects on freight I alluded to earlier sounded loud and clear about the constraints.

Mark Gaynor: I am very pleased with the positive support from the Government so far. We need to wait and see what the transport decarb plan says. We are looking for a stable, long-term policy framework and not chopping and changing and U-turns, which destroy industry confidence.

On appraisal, the work that the TDNS programme has done has looked at the whole-programme business case for electrification and the use of other technologies. There is always a risk when we start looking in more detail at individual projects that they may not stack up particularly well in a traditional business case, but they may be absolutely essential in order to deliver a whole programme. That is an area where DfT needs to look beyond an individual small scheme to the big picture and what we are trying to achieve.

Q60 **Gavin Newlands:** And lastly, on that question, Chris.

Chris Smith: In my experience, not yet, but hopefully it will be coming.

Chair: We know that rail emits 25% of the CO_2 emissions of road freight, but we have also heard about the challenges of rail freight perhaps holding up some of the innovations. We will hand over to Simon to unpack that quandary.

Q61 **Simon Jupp:** No pressure. Good morning to the panel. I am very concerned about the potential distortion to competitiveness of the rail industry and the potential of freight being moved on to road. How should the UK industry meet the challenging threat of decarbonising its rail freight system by 2040?

Paul Smart: First off, although it has been touched on a few times already, we need to view UK freight as a system and seek to cover whatever modal shift we can towards rail freight within the capacity available now, and look at short wins to increase that capacity, so as not to view rail purely in a bubble, decarbonising rail freight, but as a contribution to decarbonising the freight sector.

We have had a lot of conversations about the very large electrification programmes being recommended, but, to use the expression from earlier, there are some no regrets schemes for rail freight that would give some fast avenues to decarbonisation. The port of Thames Gateway is less than two miles from the nearest wire, but all the trains there need diesel haul as they cannot get across the two-mile gap. The Felixstowe branch is 13 or so miles long. There is a chord in west London which would connect the electrified Great Western to the electrified North London. There are some no regrets schemes that would give us some quick wins. We need to get our shoulder to the wheel behind the electrification programmes in TDNS while understanding what alternative

technology we would use for the inevitable top and tail at the ends of certain corridors or bridges in the middle, where there are going to be gaps in the electrified network—hopefully, not terribly long gaps—that will put them within reach of the emerging technologies.

It is certainly not true to say that the industry is not looking at lower carbon fuels. I know through Chris that such endeavours are out there. Some of the freight operators are looking at some of those schemes and are excited to hear about demonstrators hitting the rails fairly soon and to see that stuff in action. That could give us some bridging technology to 2040, 2050 and the alleviation of rail freight carbon totally.

Q62 **Simon Jupp:** You are all aware that the Government have committed to publishing what they determine a cross-modal—I love that phrase—freight strategy this year. How much do you expect decarbonisation to feature in that?

Mark Gaynor: It will be interesting to see, because the Department has talked very eloquently and passionately about decarbonisation, and it does seem to be, at face value, a priority for Ministers. I certainly hope that any freight strategy has, front and centre, the need to decarbonise. It is certainly what I would expect. I would be quite disappointed if that was not the case.

Chris Smith: I hope it will be very central for three reasons. The first is that customers like it, so there is a market reason. Secondly, it will save you money. Thirdly, as it takes some effort on your part, and you might not necessarily want to invest that effort, as the other two witnesses have mentioned, I hope that there might be some incentives in that context, whether it is track excess charges, carbon costs or some other way, to encourage people that it is in everyone's interests to do it.

Paul Smart: As a reminder, the mission is to decarbonise the UK economy, or decarbonise the freight economy, not specifically just to decarbonise railways. That is important to keep in mind. I would look for mechanisms that protect what we do against inadvertent modal shift, because the timing of implementing something on rail phases differently from implementing something on road. It would be mainly to incentivise us for the longer term if we have to see a permanent uptick in the cost base of rail freight for doing what we do historically.

Q63 **Simon Jupp:** What are your thoughts on a whole-system approach to carbon reduction in transport, and how specifically should that be implemented?

Chris Smith: I am not an expert in the whole-system concept, but I have worked a lot in the prime mover, the heavy power sector—gensets, marine, rail, as well as heavy duty vehicles—and what I can say is that there must be an integration, as Mark and Paul have said, in terms of cleaner fuels or other infrastructure elements for all of those parts. Whether it is support or a central rail depot, there needs to be some sort

of cross-co-ordination of the technologies and infrastructural approach. That is the key part of any kind of change. The infrastructure has to be linked.

Q64 **Simon Jupp:** Mark, are you confident that will be the case?

Mark Gaynor: The Department certainly talked a lot about looking economy-wide at decarbonisation; for example, on the basis that it may be too expensive to take carbon out of one part of the economy, you could over-deliver in another. That is a sensible approach. Building on what Paul said, we do not want to inadvertently penalise rail freight and inadvertently then transfer more freight to road because we cannot fully decarbonise rail freight itself. We need to take a holistic whole-system approach.

Paul Smart: A lot of these conversations might be about timing. The HGV road fleet, for example, whatever technologies emerge to make it successful, theoretically probably has a five or six-year turnover before all those carbon emitters are renewed for something new. In rail freight, at the moment it is quite difficult to know how to order a locomotive. It is difficult to know what to order now for the future. There is a timing point as well as a total cost point that we need to manage holistically to make sure that we do not create inadvertent adverse carbon consequences.

Q65 **Gavin Newlands:** My question is parochial and national. My constituency is home to the Malcolm Group. They put forward a proposal for a scheme of 48 tonnes for 48 miles, as they call it, which would increase gross vehicle weight allowance from 44 to 48 tonnes within 48 miles of a freight or rail freight terminal to allow for much more intermodal freight transport. They forecast that it could reduce road freight transport by 70 million gross tonne miles and reduce associated emissions by 40%. The Government announced a consultation on a pilot scheme of that very proposal two days ago. Would that proposal in your opinion make rail freight more practical and cost-efficient, in addition to the environmental benefits?

Paul Smart: The clue is in the name. If it is close to a railhead from which the trunk haulage has been delivered by rail, arguably it unlocks greater potential going forward. I guess the nervousness is that the local limit around the railhead gets extended, and suddenly it becomes the trunk haul. My immediate reaction to that is a caveat around where it might play out in the longer term.

Q66 **Gavin Newlands:** Chris?

Chris Smith: I am not a great expert in these things. What you just said about what the Malcolm Group is trying to do makes a lot of sense to me.

Q67 **Gavin Newlands:** Mark, do you have anything to add?

Mark Gaynor: Paul has answered the question for me.

Q68 **Lilian Greenwood:** If there is a big investment in infrastructure that

enables rail freight to decarbonise, for example, via electrification, is there a danger that it has an adverse impact on track access charges and, therefore, affects rail freight's competitiveness vis-à-vis road freight, or should the Government be doing more on track access charges to get a shift from road to rail anyway? I don't know who is best placed to answer that—maybe Paul, as you ran a rail freight company.

Paul Smart: In terms of track, whatever infrastructure is put down, the rail freight haulier will not just be paying the cost of electricity; we will pay a contribution towards the share of distribution of the electricity. What we hope and rely on is that the infrastructure cost of delivery of that electricity was not out of line with what is emerging now on the existing electrified network. Its costs are reasonably well understood and are priced into electric freight now. It is dealable with, from that point of view. What was the second half of your question?

Q69 **Lilian Greenwood:** Can the Government use track access charges as a way of incentivising the movement of freight off the road and on to rail, and should they?

Paul Smart: We are aware that on some limited corridors there is already modal shift support for bringing volume on to rail. That is clearly appreciated and can make a difference. The other opportunity that electrification brings is that the trains, relative to the diesel trains that they would replace, and where the infrastructure permits, can be a bit longer and heavier, so we can squeeze more freight on to make the rail freight half of the contest a little more advantageous.

That is to be encouraged because it is doing what rail freight does best—greater volumes over reasonably long corridors. The sector would welcome any effort to encourage freight on to rail, and defensively to stop adverse movements, if the timing and phasing of implementation, as we keep talking about, means that road gains a temporary advantage, and we end up dragging volume off the rails.

Q70 **Lilian Greenwood:** Mark, is there anything you want to add?

Mark Gaynor: No, other than a general point about aligning all incentives in rail to support decarbonisation. I agree entirely with what Paul said.

Q71 **Chair:** My question is pretty straightforward, so it won't need a lengthy answer. How adequate do you feel that the current level of Government support for research and development funding is to identify the innovative ways that we have discussed would decarbonise the network?

Chris Smith: I would answer somewhat like Leo. G-Volution has been very well supported by Innovate and RSSB in our endeavours. Nevertheless, the final breakthrough to engagement is a very difficult thing to do, partly because of Network Rail's and other freight operators' reluctance to adopt cleaner fuels for reasons that are rational and

understandable, but ultimately lead to no change happening—a "Why would we take that risk?" approach. The funding for innovation is good.

If we were able to put on to the rails tomorrow a demonstrator that cost £1 million to £1.5 million for a freight loco, to demonstrate 50% fuel cost savings and 30% or more carbon savings, and we could get the money to do that having got to that point, it would be a great help. Generally, the structure of UK innovation financing could be greater because rail is so expensive and difficult, but it is very well targeted and is run by incredibly impressive people.

Q72 **Chair:** Thank you, Chris. That is an interesting response. Mark, over to you.

Mark Gaynor: Sometimes, it can be quite difficult, as we heard in the previous session, for people with innovative technologies to actually engage with the railway and get access to a live rail environment to test and trial. I am sure we could make that easier, to make the best use of available funding.

One thing I have noticed is that when, for example, the Department is running a broader low-carbon programme, perhaps through the Office for Low Emission Vehicles, sometimes it is not possible for rail to get involved. Maybe that is something that could be looked at to make sure that, whenever DfT in particular is running an innovation or research initiative, there is an opportunity for rail to engage.

Q73 **Chair:** Paul, is enough of the R&D budget being devoted to decarbonising rail freight?

Paul Smart: We could always use more. I am aware of a couple of schemes that look at alternative fuels that managed to fail to get Innovate UK support in competition, and lost out to non-rail schemes. There is more to do. To support Chris's point, it might mean that some of the funding needs to be slightly more generous and quicker, so that we can put a real demonstrator out on the network. There is nothing like the ability to kick the tyres. This is a low-margin business. People have extremely busy day jobs, and seeing something demonstrated for real is worth a thousand papers, submissions and technical drawings. More power behind the elbows for building something, showing it off and letting us see it.

Q74 **Greg Smith:** Christopher, this is particularly a question for you. I am very keen to see, as are the Government, SMEs getting a fair crack at access to provide the innovation that we need. Looking back through history, some of the biggest technological advances for things that improve our day-to-day lives often get invented, created, and discovered by smaller enterprises, if not in someone's shed, to start with. As an SME, what challenges have you faced entering the rail industry, and how could the state, the Government, make it easier for SMEs to break into the market properly?

Chris Smith: I do not want to overstate this because I work as a part of a team. The rail environment is incredibly challenging, as Leo mentioned more eloquently than me. It is very difficult for the Government to do much more than they do, except for three things, which I would clearly identify.

The first is the scale of funding that you need focused on rail, which would enable a demonstrator, as Paul said. That is a hugely valuable thing. We have spoken to the Rail Minister and the DfT, and been put in touch with a state-owned rail company to see if we could encourage them to do a demonstrator. We targeted that as an idea because it would really help us. It is the scale of the fund and the ability to demonstrate something for a reason. Here I am, saying to you, use this technology now, we have done papers on it—extremely good research papers for the RSSB showing the demonstrator and the benefits, as Paul said. But seeing is believing, and if you watch our video for a couple of minutes, if I could impinge on your time for that, you will see what we mean. If you see it, you believe it could happen. If we could do that at scale, it would be an immediate step forward.

The second thing would be to include us in a strategy. I am not saying you should agree with me, but my feeling is that on clean fuels we have a lot of experts in the Advanced Propulsion Centre and in the IEA who accept that cleaner fuels are part of the transition, both for immediate, available transitional technology and for the infrastructure of tomorrow. Putting it into a structure would be good.

The third thing would be, in that context, to try to see that decarbonisation—we prefer to say defossilisation, because that is more the focus of the cleaner fuels—will benefit the operator. You would have thought that a fuel cost saving of 30% would be enough to encourage people to change, but my experience is that a large number of people will say, "We're going to run those diesel engines for the next 20 or 30 years and then we'll just turn them off. Why would we take the risk?" It is a little bit as Leo said. You are stuck in a cycle of, "Can't you see the benefit? No." It is not really enough.

I criticise myself. When I started this business 10 years ago, I thought, surely if you are making the world a better place, saving carbon and saving yourself money, isn't that going to motivate you? The honest answer in a lot of these situations, bizarrely and for lots of different reasons, is that it is not. Life would be a lot easier without customers, you could say in response, and I accept that that is part of the criticism. You asked me what the Government could do. Those three things are key.

Q75 **Sam Tarry:** With the plans that are going forward for a Government White Paper and the Williams review, we are going through a huge period of change. The Covid crisis impacted on the railways in a dramatic and huge way, meaning that the railways were almost partially nationalised,

in my view. Thinking forwards about potentially moving out of the Covid period, how do you think the Government can begin to think about reforming the passenger service in contractual arrangements that would incentivise carbon-free railways? Chris?

Chris Smith: I am no expert on franchising at all. This goes back to part of the point of the whole session, which is how you get holistic change to occur. My feeling is that, if there was some legislation and incentives around carbon that were properly measured and universally applied, that would be the best way to drive the change, along with everything else we have talked about.

Q76 **Sam Tarry:** Paul, do you have a comment on that?

Paul Smart: Truthfully, I have no real locus to comment on a future organisation of how passenger services are let, so I will pass on that one.

Q77 **Sam Tarry:** In that case, over to you, Mark.

Mark Gaynor: I think I mentioned in an earlier answer the need for alignment. We need the decarbonisation plan. It is not just about infrastructure change. It is also about ensuring that train operators play their part, whether through the introduction of new rolling stock or energy efficiency initiatives. We need soft targets and incentives running down to train operators.

It is interesting that, before the current pandemic, we were already seeing a change in travel patterns and behaviours, with the move away, for example, from traditional five-day-a-week commuting to major cities, and the pandemic has accelerated that. We can expect to see some ongoing permanent changes in how people want to live and work.

As I mentioned earlier, there is a need to ensure that our fares and ticketing systems keep up with those sorts of changes. There are some constructive discussions taking place between the industry and Government around flexible season tickets, and that is good. We would argue that we need to go further to give operators the tools to be able to maximise and make best use of the capacity they have and encourage people to get back on to the railway by offering good value, easy to use flexible fares.

Q78 **Sam Tarry:** In terms of companies that might be bidding for future contracts, there probably won't be a franchising system, but there probably will be some process for people to participate and bid as private enterprises. Do you think there could be things that are built in that would challenge those companies, and, therefore, incentivise them to come forward with proposals? Could the Government say that if they want to bid and be successful in winning one of the new contracts, in whatever shape they end up taking, there are criteria that have to be built into the new agreements?

Mark Gaynor: Absolutely. We should be looking to harness innovation, get new ideas and encourage ambitious proposals. We would certainly see that as an important thing that the private sector could bring to bear in any future management contract.

Q79 **Sam Tarry:** Do you think that has been made more difficult by the current emergency measure recovery agreements?

Mark Gaynor: The limited length of the ERMAs and the lack of clarity at this stage about what will happen next inevitably makes it quite hard to judge what impact the successor to the ERMAs will have, until we see more about the detail through whatever comes out from Williams and wider rail reform thinking.

Q80 **Sam Tarry:** Christopher, do you want to make any comment on that?

Chris Smith: There were, in some recent franchises, carbon targets. They are a very good way to encourage change, and they are part of what I talked about: track access, carbon tax and trying to get a holistic response to the whole situation. They need to be measured quite carefully because, if they are put on a kilo per passenger basis, more passengers get you your carbon target, which is not quite where we are coming from. In principle, it is a very good way to drive change.

Q81 **Sam Tarry:** With the Government likely to publish the Williams review and the transport decarbonisation strategy in the next few months, what are the three most important things that should be in those reports that would support decarbonisation across the networks?

Chris Smith: For me, they are the use of cleaner fuels immediately, the development of a shorter-term strategy—5, 10, 15 years—to create an infrastructure, and some sort of benefit, such as carbon tax or track access, for those who take the routes around decarbonisation.

Q82 **Sam Tarry:** Paul, would you like to comment particularly from the freight perspective?

Paul Smart: I would go back to the no regret wins. A short bit of electrification could uncork opportunities for freight decarbonisation. I would want to have a mechanism that prevents disparity between road and rail while we go through the transition, because of the phasing and timing things I spoke about earlier. In terms of the new structure of the network operator, although this is a familiar statement from the freight community, we need to have our needs viewed as a corridor from A to B, not aligned to the devolved geographies of Network Rail's potential future structure. It is about making sure that we have a guiding mind and an ability to influence at the corridor level, rather than regionally.

Mark Gaynor: Building on Paul's point, we would very much want to see the creation of an independent guiding mind or arm's length body that could take the strategic objectives of Government and turn them into a whole-system plan, encourage Network Rail get on with the electrification

plans, ensure that whatever came through in the future of franchising was aligned to that, and hold people to account for delivery. They should also, as Paul said, take a network view. Is the whole railway network working? Trains do not necessarily just travel within a Network Rail geography. They travel through and across all parts of the country, so you need to make sure that happens. The other thing, which I touched on before but will mention again, is fares reform and carbon target incentives—in particular, making sure that they flow through into future franchises.

Q83 **Chair:** The "Trains fit for the future inquiry?" is designed to look not just at how the trains are actually powered but at what the passenger experience will be like on board the train. That is a particularly challenging point with the Covid pandemic and the concerns of passengers.

Mark, what changes would you like to see in the design of trains to improve the passenger experience, both to boost passenger numbers and to improve accessibility for passengers?

Mark Gaynor: To pick up on what you said about the pandemic and how it has changed passenger expectations, we are trying to focus on demonstrating that it is safe to travel by train. We do an awful lot around cleaning, ensuring that people wear face coverings, and providing as much space as possible on trains. That feeds into future design. The industry is working closely with Government to look at how we can ensure that ventilation systems and filtration systems on trains are effective against viruses like Covid-19 and, potentially, future pandemics, with the use of materials that are inherently resistant to viruses, and ensuring that the design of the train itself makes it conducive to cleaning.

That is something we were not thinking so much about a year ago, but it is very much in the industry's thinking now. In terms of design, some of it is around getting the basics right: safe and secure environments; good lighting; level access; ensuring there is provision for wheelchair users that is not compromised by other usage in the travelling environment; the ability to communicate with staff if there are any issues; and visually that it is easy to navigate the train and find out where things are.

We know that customers increasingly want realtime information, not just in the train itself; if they have booked trains using their mobile phone, they get personalised information. That information can not only talk about where the train is going, but provide information on availability of toilets or where there is more space in the carriage, which will become increasingly important.

The industry is exploring flexibility in the use of space on the train. That might be something we spend more time thinking about, given how people's travelling patterns may change. For example, could we have reconfigurable interiors that can provide higher capacity at some times of the day but can be modified to provide a more comfortable experience in

the off-peak? That means we can be more accommodating of bicycles, to support the increased move towards active travel. Paul will be pleased to hear that there is interest in how we can perhaps use spare capacity on passenger trains to carry high-value freight into and out of city centres. That has been done on a small-scale pilot so far, but there might be opportunities to do more in the future.

Those are a few initial thoughts. The pandemic is something we will need to think about very carefully in how we design rolling stock going forward. We need to understand better the needs of our customers and their future travelling patterns and what they need from rail.

Chair: Thank you very much for giving us that insight as we look into that part of the inquiry a little further.

Thank you very much Mark, Paul and Chris for allowing us a glimpse into the future and what is possible. It is very fitting that we were able to pay tribute to all those who gave us the freedom to do just that over previous decades. Thank you very much. We look forward to continuing the inquiry.