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HOUSE OF COMMONS
OFFICIAL REPORT
GENERAL COMMITTEES

Public Bill Committee

AUTOMATED AND ELECTRIC VEHICLES BILL

Second Sitting

Tuesday 31 October 2017

(Afternoon)

CONTENTS

Examination of witnesses.

Adjourned till Thursday 2 November at half-past Eleven o'clock.

Written evidence reported to the House.

No proofs can be supplied. Corrections that Members suggest for the final version of the report should be clearly marked in a copy of the report—not telephoned—and must be received in the Editor's Room, House of Commons,

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Saturday 4 November 2017

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The Committee consisted of the following Members:

Chairs: MR ADRIAN BAILEY, † SIR EDWARD LEIGH

† Argar, Edward (<i>Charnwood</i>) (Con)	† Mann, Scott (<i>North Cornwall</i>) (Con)
† Brown, Alan (<i>Kilmarnock and Loudoun</i>) (SNP)	† Rodda, Matt (<i>Reading East</i>) (Lab)
† Duffield, Rosie (<i>Canterbury</i>) (Lab)	† Stephenson, Andrew (<i>Pendle</i>) (Con)
† Efford, Clive (<i>Eltham</i>) (Lab)	† Stewart, Iain (<i>Milton Keynes South</i>) (Con)
† Foxcroft, Vicky (<i>Lewisham, Deptford</i>) (Lab)	† Tracey, Craig (<i>North Warwickshire</i>) (Con)
† Hayes, Mr John (<i>Minister for Transport Legislation and Maritime</i>)	† Turner, Karl (<i>Kingston upon Hull East</i>) (Lab)
† Jones, Graham P. (<i>Hyndburn</i>) (Lab)	† Western, Matt (<i>Warwick and Leamington</i>) (Lab)
† Kerr, Stephen (<i>Stirling</i>) (Con)	Farrah Bhatti, Mike Everett, <i>Committee Clerks</i>
† Knight, Sir Greg (<i>East Yorkshire</i>) (Con)	
† Letwin, Sir Oliver (<i>West Dorset</i>) (Con)	† attended the Committee

Witnesses

Steve Nash, Chief Executive, Institute of the Motor Industry

Brian Madderson, Chairman, Petrol Retailers Association

Steve Gooding, Director, RAC Foundation

David Wong, Senior Technology and Innovation Manager, Society of Motor Manufacturers and Traders

Robert Evans, Chief Executive Officer, Cenex, and Chair, UK Electric Vehicle Supply Equipment Association

Suleman Alli, Director of Strategy, UK Power Networks

Marcus Stewart, Head of Energy Insights, National Grid

Quentin Willson, Journalist and TV Presenter

Stan Boland, Chief Executive Officer, FiveAI

Denis Naberezhnykh, Head of Ultra Low Emission Vehicles and Energy, Transport Research Laboratory

Public Bill Committee

Tuesday 31 October 2017

(Afternoon)

[SIR EDWARD LEIGH *in the Chair*]

Automated and Electric Vehicles Bill

Examination of Witnesses

David Wong, Steve Gooding, Brian Madderson and Steve Nash gave evidence.

2 pm

The Chair: Welcome to our afternoon session. We will now hear oral evidence from the Society of Motor Manufacturers and Traders, the RAC Foundation, the Petrol Retailers Association and the Institute of the Motor Industry. We have until 3 pm, when there may be votes. Would the witnesses please introduce themselves for the record?

Steve Nash: I am Steve Nash, chief executive of the Institute of the Motor Industry.

Brian Madderson: I am Brian Madderson, chairman of the Petrol Retailers Association, which is part of the Retail Motor Industry Federation.

Steve Gooding: I am Steve Gooding, director of the RAC Foundation.

David Wong: I am David Wong, senior technology and innovation manager of the Society of Motor Manufacturers and Traders.

Q87 Karl Turner (Kingston upon Hull East) (Lab): Thank you very much indeed for attending. The Minister suggested on Second Reading that the Bill would deliver a cost saving to people who are insured on automated and autonomous vehicles, because they will be safer. Do you think that that is correct? Will insurance be cheaper?

Steve Nash: I will kick off, if you like. Right now, electric vehicles can cost anything up to 50% more to insure than comparable vehicles that are not electric. There are couple of reasons for that. An element of that is the cost of the vehicle, but a large part of it is the relative lack of skilled people to work on them. The insurers, naturally, load the premium because they expect to pay a higher cost to get the vehicles repaired, but provided the right mechanisms are in place to ensure a competitive market to service and maintain those cars, there is no reason they should be more expensive. In fact, if you take it to its logical conclusion, with sufficient fully autonomous cars on the road, accidents should go down.

Steve Gooding: May I echo that? It is a question of penetration—the number of autonomous vehicles out there. In the transition, when there are still a lot of conventional vehicles, someone in a driverless car might be a lot safer but will still face the risk of someone colliding with them. In the early stages, because of the technology built into the vehicle, that might be quite an

expensive accident, which might put premiums up. In the longer term, however, as Steve says, as we see greater penetration, a lot of the human error that is the cause of crashes on the roads today will be ironed out by the technology.

David Wong: On the basis that 94% of all crashes involving a fatality are put down to human error, and that the modelling we published two years ago suggests that connected and autonomous vehicles are expected to save 2,500 lives and contribute to the avoidance of 25,000 serious crashes between 2014 and 2030, we certainly hope that with autonomous vehicles, insurance premiums will go down.

Q88 Karl Turner: Thank you. Do you think that there is a necessity for licensing and accreditation for technicians? Should that be in the Bill?

Steve Nash: I feel very strongly that there should be, on a number of counts. First, we have electricity at work legislation that was put in place at a time when electric vehicles were virtually non-existent, although it does refer to electric vehicles—believe it or not, it actually tells people to talk to my organisation about them. But it is patently obvious that there is an inconsistency in regulating people who work on mains electricity, which is 240 V, while being happy for anybody to work on a vehicle that could be between 600 V and 1,000 V if we include commercial vehicles. To be really clear and specific, I am not talking about general licensing. I am talking about regulating people to work on the high voltage elements of these cars, not to change the tyres or to do the mundane stuff. These vehicles are wholly different to internal combustion engine vehicles. In the fullness of time, and it will not be that long, quite large numbers of them will start to come out of warranty and find their way into the open market. Right now, only 1% of those who work on the maintenance of vehicles in the whole country are actually qualified to work on the high voltage electrics and they pretty much all work for franchised dealers. Putting a regulation in place would open up the market to the wider industry and provide a standard that everybody could recognise.

Q89 Karl Turner: Why can you not just let the industry get on with it? Why does it need to be in the Bill?

Steve Nash: Because it will not happen. I have been in the industry for 40 years. We have a great deal of support for this from huge independents such as Halfords, from a lot of manufacturers and a great many independent garages. When we talk about the independent sector, it is an indeterminate number, roughly 40,000 businesses, we estimate, but we do not know exactly who is working on cars, because they do not belong to a body. It could be anyone; there is nothing to stop anybody setting themselves up to service and repair these things tomorrow. It will only be when somebody kills themselves—there have been incidents outside this country already of people being killed or seriously electrocuted working on these things. Don't get me wrong, they are perfectly safe to ride in and operate, but once you get under the skin, if you do not know what you are doing, you are in just as much danger as you ever would be playing around with mains electricity without knowing what you are doing, except that it is potentially more fatal, because it is direct current and it will not throw you off, it will just keep electrocuting you.

It would definitely help the market, because manufacturers will do what they have to do to sell the cars and make sure that their own people are competent, but it will not automatically happen. It is a coin-operated business outside the main dealers. We have investigated what happened when Corgi or Gas Safe were put into place, similarly with the electricity at work legislation. Very quickly you would undoubtedly have had a lot of practitioners who should not have been doing what they were doing back in those days, but very quickly the industry raises to that level and it becomes a competitive market again and you do not get unreasonable costs introduced. We believe that is the right thing to do here. It establishes a common currency across the industry for knowing what competence means.

Karl Turner: With Sir Edward's permission, does any other witness want to comment?

The Chair: It is not necessary for all the witnesses to answer all the questions. I am anxious as many colleagues as possible get in. I know the Minister is anxious for his voice to be heard, which we await with alacrity.

Q90 The Minister for Transport Legislation and Maritime (Mr John Hayes): Thank you, Sir Edward. Steve, you were previously very supportive of the Vehicle Technology and Aviation Bill, the forerunner of this Bill, particularly of the measures on AVs. Can you tell me why and why you think it is right that the Government bring this kind of legislation forward now? How important is it that in order to encourage further development we establish a legislative framework?

Steve Nash: We are going through what is the biggest change in the industry—

Mr Hayes: Sorry, I directed the question to Mr Gooding

Steve Nash: Sorry, I beg your pardon.

Steve Gooding: There are two Steves.

Mr Hayes: That is the trouble with two Steves. I do apologise.

Steve Gooding: I am sure Steve will come in in a second. Yes, the foundation has been very supportive of both aspects of the Bill before you today. Specifically on the electric vehicle side, we think that while there have been significant percentage increases in the take up of ultra-low emission vehicles, they are still a tiny fraction of the overall vehicle park. There are many reasons why the ordinary consumer could get confused by what is on offer to them with various different charging packages for how to pay; with big uncertainties about the availability of different charge plants and on-street charging. We think that if the Government are serious—and we know that you are—about rapidly increasing the take-up of ultra low emission vehicles, something needs to be done to make the world of those low emission vehicles easier for consumers.

The Bill takes the perspective of asking, “What are the things that may currently cause a consumer to think twice or just to think, ‘Not now?’” There is concern about range. Well, the auto companies are dealing with that, because the range of the vehicles is getting longer,

but there is also concern about the complexity and ease of recharging, about whether a particular charge point will be available and working when someone pulls up, and about whether it will be the right sort for the vehicle that they have. If we are able to clarify those things and make them simpler, the market will be a lot more attractive.

Q91 Mr Hayes: I want to pick up a point that Mr Wong made about safety. Is it your estimation that there will be a graph, if you like, and that as vehicles become automated in part they will become safer, and as they become safer accidents will fall? We now have assisted parking, for example, and my wife tells me that that means I am less likely to bump the car, because I get a bit of help with reversing. Could we develop an understanding of a growing level of safety as a result of partial automation?

David Wong: The best way to answer that question is to look at what is already available today in terms of automation. We do not have autonomous vehicles yet, just to be clear—we are unlikely to have autonomous vehicles until around 2020 or 2021—but what we do have is increasing levels of automation. The best example to quote is autonomous emergency braking, which is essentially level 1 or level 2 technology, using SAE International's definition. AEB has already been shown to have contributed to the reduction in real-world rear-end crashes by 38%.

Mr Hayes: How very interesting.

David Wong: That is an empirical study.

Q92 Sir Oliver Letwin (West Dorset) (Con): We heard earlier from the insurance industry that they had been led to believe that autonomous vehicles, as they evolved and eventually came to market, would inevitably contain software that would enable the vehicle to reject a transfer from the driver to the autonomous system if it was in a location that made it unsafe for the autonomous system to operate. I am talking about the period during which we do not have cars without any steering wheels but we have ones that are sometimes autonomous and sometimes used by drivers. Do you share their confidence that vehicles will always be manufactured with software that prevents handover to the autonomous system except where it is totally safe?

David Wong: I think it is more likely to be the other way around. That is, it will be a question not of whether the system rejects a request from the driver to hand control over to the vehicle, but of whether the system serves up the offer of automation to the driver, given the right and safe conditions.

Q93 Sir Oliver Letwin: Does that mean that if the system does not make the offer, the driver will not be able to give it control?

David Wong: Correct, and I can give you an example. It is not autonomous yet, but it is level 3, which is very close to autonomous; this is the next step towards autonomy. Audi is the first vehicle manufacturer in the world to launch a level 3-capable vehicle. It launched it in the summer, and it will be available on the market, all being well, next year. Its system, which is called traffic jam pilot, is designed to operate at speeds of no more

than 38 mph, on dual carriageways with clearly marked road signs as well as lane markings, and where the vehicle is hemmed in by other vehicles on the left and right, and front and back. If the system detects that all those conditions are met and the weather is sufficiently good for the operation of traffic jam pilot, it will offer the driver the option of giving the system control during that use case. Once one of those conditions is no longer in place, no longer valid—perhaps traffic has dispersed and the vehicle is able to travel at more than 38 mph—then the vehicle will ask the driver to take back control. So it is the system that will detect and serve up the offer; it is not the driver requesting.

Q94 Sir Oliver Letwin: Thank you. A question about charging points, which you were talking about: how important do you think it is that there should be a charging point in every place where there is a lawful parking space by a pavement in a city or town? What kind of timescale would you envisage for needing that level of penetration?

Steve Gooding: I doubt whether we would need precisely that level of penetration. A report that we recently published—and thinking about how the Bill's powers might be used if the House grants them—draws out the important point which is to think about the sort of trips that people actually make. For example, in large parts of London, in residential areas where there is no off-street parking, if we are to see a wide-scale move to plug-in electric vehicles, we would need to see quite a lot of roadside recharging capacity, because lots of people would be charging overnight, because that is what is most convenient for them. Elsewhere, if people are charging overnight at their homes and perhaps looking to top up the charge at their destination, it is probably more likely that that destination might be their place of work where there is off-street parking, or it might be a shopping centre or a multi-storey car park. So we are probably not talking about universal coverage but certainly more than we have today.

Quite how fast that needs to happen, I am afraid I could not give you a figure for now. All I can say is that at the moment there are various figures. Research by Addison Lee, for example, suggests that a very intense increase in on-street presence would be needed if we were to have the sort of ramp-up of vehicles that it would be willing to engage in. I would probably focus on making sure that the grant scheme for home charging carries on, so that we encourage more people to have the facility to charge at home. Then I would probably focus on motorway service areas, which will be very important for short and rapid top-up for people making a longer journey but who are possibly anxious about managing the whole journey there and back.

David Wong: If I can quickly echo what Steve said, it is no longer about the number of charge points, because we have around 14,000 in the UK at the moment, which is one of the highest numbers in Europe, if not the highest; it is about where these charge points are—being in the right place to serve particular needs, so it is not every charge point in every corner of a neighbourhood. First and foremost, what the Bill will provide is actually a step in the right direction, and so this is something we totally support in terms of the infrastructure. This calls for a co-ordinated approach involving the Government, the SMMT, the industry, vehicle manufacturers, charge point operators, energy companies and local authorities

to come together, convened by Government of course, using the Government's convening power, to determine and plot where the right charge points ought to be, depending on usage, the likely needs of people to charge and the type of charge points, because they might be fast chargers—rapid chargers—as Steve hinted.

Q95 Sir Oliver Letwin: Do you think that there needs to be, in effect, a national plan for the location of the charge points as we approach 2040?

David Wong: We would suggest a nationally co-ordinated approach.

Brian Madderson: I speak for 75% of the motorway service areas and the one thing that they are really against is any form of mandating, because they want the market to be able to choose what is the best form of charging at the time for them. This is in a great state of flux. Some of them have already entered into agreements that are more binding than perhaps they would have wished with the knowledge that they have just 12 months on. The mandating process seems to be all stick and no carrot. These motorway service areas fully recognise the need and, in fact, many now have both Tesla charging and other forms of charging, so they are working towards that but they think mandating is not appropriate in this case.

One of the other issues the motorway service areas have is that there does not seem to be joined-up government, which I think David was probably referring to. There are planning difficulties in getting car park extensions to put in extra parking bays for Tesla charging, for example. One of the things the Government should perhaps be mandating is not where the charging points go, but that where there are planning applications for charging points, local authorities must deal with them quickly, efficiently and sympathetically.

Q96 Clive Efford (Eltham) (Lab): What is the incentive to develop the automated car technology? Is it large fleet owners who employ a lot of drivers wanting to cut down on their overhead staff costs? Or is it the private car industry?

Steve Gooding: From a consumer perspective, I would have to say that we do not really know yet, but there is a broad spectrum of what might happen next. For example, there is a clear incentive for a fleet operator who is counting every penny to be thinking, "How could I reduce my costs of operation?" Whether that is a fleet of vans or trucks, the operator would be looking at automation as a way of, first, saving money, and secondly, sweating the asset of that truck for longer hours. In turn, we are seeing a huge amount of investment in the auto sector in vehicles for the private market.

If I were to bet my money, I would say that the guys who are counting every penny will probably be the first in—people running fleets and large numbers of vehicles—but some people are clearly very attracted to the thought of having driverless capability. That could be from time to time, or it could mean freedom and independence for people who are currently denied that by the fact that they cannot drive, and we have just been engaged in a report on what it means for people with disabilities.

Q97 Clive Efford: Are we not a long way off from those sort of automated vehicles?

Steve Gooding: I think David would say we are four years off. Personally I think it is probably nearer 10.

Steve Nash: Ten.

Q98 Clive Efford: There is a difference between an automated vehicle that can undertake a journey on a motorway and a vehicle that would have to drive around the roads here in Westminster. If it is going to provide that sort of access for someone who cannot drive at the moment because of a physical disability, it has to be that high level—level 5—of automation.

David Wong: Correct. In the first instance, when I referred to 2020-21, I was referring to level 4—vehicles that will still have a steering wheel. That means under the right conditions, in the right use cases—for example, from junction to junction on a motorway—someone could let the system drive the vehicle, but could take back control outside that use case. If level 5, which is without a steering wheel, is not going to be as far off as 10 years, it is likely to be deployed in the first instance for first and last-mile journeys, perhaps even in pedestrianised areas—on pavements—as we have seen with some of the trials in Greenwich, as well as in Milton Keynes. As to when those level 5 vehicles without steering wheels are capable of performing end-to-end journeys—from my house in the village to my office in the city—that is anybody's guess. That will probably be some time in the 2030s. It is quite complex.

Q99 Clive Efford: Can I ask about the figure of 95% of accidents caused by human error? Who else can drive a car and cause an error? At the moment we do not have automated vehicles. Is that not a bit of an obvious point—most accidents are caused by humans because cars, de facto, are driven by humans?

David Wong: I suppose you could—

Q100 Clive Efford: Can we expect that figure to go down as a proportion of the accidents, as we increase the level of automation?

David Wong: Yes. In principle, one would not argue that a computer is less safe than a human being. Obviously, the capability of a human being to perceive and perform the driving of a car is limited and depends on the human being's condition and the road conditions, as well as the environment in which the human being has been conditioned to perform the dynamic driving task. Lots of evidence has been published. The figures range from 90%; some are at 97%. We are taking the average figure, which is that 94% of all serious road accidents involving fatalities are caused by the human being. I mean that in the sense that it is not mechanical fault, lack of road markings or slippery roads, but the human being that caused the accident, perhaps by being inattentive or sometimes even perhaps by doing things that they are not supposed to do.

Clive Efford: But even the slow-moving vehicle in Greenwich hit a plastic chair when it was put in front of it, did it not? We are going to see accidents during a journey where the vehicle is being driven by software. Those accidents are going to happen. The periods when a vehicle is not driven by a human are going to increase, so we are likely to see an increase in the number of accidents that are not human error. Is that right?

David Wong: We think that overall the number of accidents will fall, but if anything can be learned from one of the trailblazers of the self-driving car experiments and trials—Google—it is that the earliest accidents that

they encountered a number of years ago when the car was being trialled were the result of the cars being rear-ended by manually driven vehicles. The learning from that was that Google had to tweak the algorithms to ensure that the self-driving vehicle—the computer—behaved a little bit more like the human being. They succeeded in doing that, and today you do not get so many of the rear-ending accidents.

Steve Nash: It is also important to say that these vehicles will be connected. When one experiences something, the knowledge is passed to all of them, which does not happen today.

Q101 Clive Efford: I was going to come to that, if the Chair indulges me. You touched on the issue of the vehicles making decisions. In an incident where a vehicle is being driven by software on an automated journey and a child runs out in the road in front of the vehicle, the vehicle can either veer to the left into oncoming traffic or to the right on to the pavement, or it can knock down the child, because the child is too close for it to be able to stop. How do we make a moral judgment about how a vehicle should behave in those circumstances?

David Wong: This is the classic trolley problem question that we get asked almost at every single conference that we attend—

Q102 Clive Efford: Yes, but we have to legislate.

David Wong: Not at this point, but at some point certainly. First, if you take a cue from the ethics commission report that was published in Germany just a few months ago, it suggested that in any case, human life should always be prioritised. If it is a decision between a human and non-human, obviously the human life would have to be prioritised. That is No. 1. Secondly, we should not expect the car to do anything massively different from how a human being would behave. The car should perform a minimal risk manoeuvre to stop and brake in such a way that the impact will be minimal. To expect the car to make an ethical decision to kill A or B is probably not the right approach. I would suggest that none of us has the divine power to decide who to kill. At the end of the day, someone who writes the algorithm will have to decide. If you insist that the car must decide, it is incumbent on the engineers to programme that into the algorithm.

Q103 Clive Efford: So no evasive action would be taken. The vehicle would just—

David Wong: There would be a minimal risk manoeuvre, depending on the situation. There may be evasive action in such a way that it would be the safest possible option. If it needs to stop, it will brake and stop. May I point something out? I mentioned autonomous emergency braking. It has been demonstrated that the technology is improving all the time. Previously, autonomous emergency braking worked perfectly at 30 mph, which is urban speed, but it is becoming increasingly sophisticated. AEB can work well even at 50 mph. It would not surprise me if the technology improved in years to come to the stage where autonomous emergency braking could kick in at motorway speeds of 70 mph to prevent an accident or lessen the impact of an accident.

The Chair: I have a growing list of people who want to ask questions, and I want to try to get everyone in. We want brisk questions and brisk answers. It is not necessary for every witness to answer every question.

Q104 Edward Argar (Charnwood) (Con): This is probably more to Mr Madderson. You touched on mandating or not mandating particular solutions. Do you have any assessment, either anecdotal or based on research, from your members? The big retailers may well be able to adapt over time and have different types of fuel supply, charging points, conventional fuels and so on. What is your assessment of the ability to adapt of smaller local retailers of fuel, or your feeling about the impact?

Brian Madderson: They are all extremely interested in this new technology and we, in fact, are providing a route to market for many of the charging point suppliers. They come to our regional forums—Northern Ireland, Scotland, England and Wales—and they appear in our market review book, so there is a thirst for knowledge.

The real problem with the Bill as it is currently written is that in mandating motorway service areas and, indeed, large fuel retailers there is a key missing ingredient, and that is the carrot I referred to before. There is funding for charging points at home, on the street, in the workplace and in other public areas but there is no funding available for the fuel retailers who would like to embrace this technology in order to provide a diverse range of refuelling options for their customers. It is the big rump of the medium to small-sized filling stations right across the country that will find this more difficult, because the investment decision at the present time is not something that banks would support. There is almost no money to come back on a perceived return-on-investment basis. So they are the ones who will be holding back the growth of charging points right across the country—it is not just city-centric.

Q105 Karl Turner: To be honest, I think Mr Madderson has answered the question I was about to ask: what are the carrots? He said it was all stick and no carrot.

Brian Madderson: It does have to be some form of funding, because if you go to your bank and say that you want to put in a charging point that might cost you a lot of money, you will immediately be asked, “What do you see as the return on investment? I’ve got to get my interest back.” They have no idea at the moment, because the market is in such a state of flux. New systems are coming on. I heard of one relatively recently called ZapGo. I do not know whether it is a big runner, but it is looking at putting storage tanks into a traditional forecourt with charging posts, and being able to meter out the electricity on a basis that I am told Her Majesty’s Revenue and Customs would enjoy because you might be able to get fuel duty back on it. This is relatively new. There are all kinds of development in the marketplace, and I think it would be precipitous to ask them to invest 100% of the money now—they could not do it.

Q106 Karl Turner: Could I ask what the average cost is? Am I right to say £50,000?

Brian Madderson: It can be up to £50,000 per instalment. What has been happening is that certain companies have gone along and said, “Look, we will take over that cost but we want from you two parking bays for 30 years on a lease basis.” If you are thinking about 30 years, that is a very long time. It precludes you, as the owner of that freehold property, from perhaps expanding your shop or putting up a new car wash—

indeed, from perhaps even selling the property to someone else. So most of them have opted away from that style of investment.

Q107 Mr Hayes: To jump back to your point, Brian—it is nice to see you again, by the way—you will know how supportive I am of small and medium-sized business of the kind you represent. Is it fair to say that the Bill begins a process of spreading the number of charging points by picking on and mandating those larger retailers, but that to get the coverage we all seek there will need to be other mechanisms, because in rural areas, for example, where many of you are based, there might be no large retailer conveniently situated? Can you see the Bill as a welcome start?

Brian Madderson: First, I do not agree at all with any form of mandating because this is interventionist by the Government in a market that is so new and in such a state of flux that there should not be mandating. This is a perfect example of where market conditions should encourage investors to invest in the product that is right for them at the time. Mandating may make them make a false decision, which would prove very costly and certainly not be beneficial for the consumer.

Q108 Mr Hayes: So Mr Wong thinks we should have a co-ordinated national strategy, whereas you think that the market should prevail. Is that the difference between you?

Brian Madderson: Yes, I think it is good to have a market strategy, but you would certainly need to have proper funding available to not only small retailers but large retailers as well. By this, I mean the independents, certainly. The big oil companies today count for relatively few of the total number of filling stations—less than 15%—across the UK.

Q109 Graham P. Jones (Hyndburn) (Lab): Obviously, you represent the motor manufacturers, and I am concerned about the shape and size of vehicles going forward and the adequacy of the legislation. My hon. Friend the Member for Kingston upon Hull here has, I think, a Twingo—do you have a Twingo?

Karl Turner: A Twizy.

Graham P. Jones: Twizy—that is it. I notice even on the continent, particularly in urban areas, we are getting smaller and smaller electric vehicles and cars driving around. Is the legislation adequate for the type and size of electric vehicle that might come on to the market? What changes do you see, for example? How will an automated vehicle work when you add a trailer to it or make some other changes to it? The shape, size and form of vehicles is probably going to change, as you are well aware, so will the legislation be adequate for those vehicles to be on the road when they are automated—of course, when they are operated by an individual manually, there is a human choice—and the automation is making choices?

Steve Gooding: I will start with a very short answer, as the Chairman seeks, which is no. But that is because this is a very immature market. We do not even have the vehicles in the marketplace yet. Having also driven a Twizy, which is great fun, I think the construction

and use standards, based on a mechanical testing of roadworthiness, should be sufficient for most of the concerns you are voicing, but they are certainly not sufficient for guaranteeing the roadworthiness of the autonomous software systems; you are going to need something new for that.

When it comes to the size of the vehicle, again, their crash-worthiness, for example, needs to be tested in the circumstances in which the vehicle will be used. Maybe then there will need to be something in addition either to prevent or constrain what other purposes—whether it be towing a trailer, a caravan or whatever—are appropriate for that vehicle.

Q110 Graham P. Jones: It is not just that. What if I set off with a trailer in manual mode but I suddenly decide to be sneaky and switch it over to automated and go to sleep? There are a whole bunch of issues around the change in form, shape and size of vehicle and going between manual and automated.

Steve Gooding: I would say a similar thing as to Mr Efford: as a consumer, if I am being invited either to travel in one of these vehicles because it is the equivalent of private hire, or to buy one, I expect to buy something that has been certified as safe for the use to which it is going to be put. If it is inappropriate for me to hitch a trailer to it and use it in autonomous mode, that had better be made clear to me at the point when I buy it.

Q111 Mr Hayes: I have one further question, on a slightly different subject. This morning, we talked about how these developments will change the nature of the skills required. Steve I, if I may call you that, mentioned that earlier. Presumably you will also acknowledge that it will give rise to new skills. There will be a shift in skills and new kinds of jobs and skills will develop. Is there not an exciting prospect of a whole range of new competences coming as a direct result of this technology? Is that fair?

Steve Nash: Absolutely, yes. There is probably more opportunity than threat from the new technologies. We are interested in ensuring that those skills develop in the right way. If you look at autonomous vehicles—I mentioned electric vehicles earlier—we only know as yet what manufacturers have said about their plans in the future. It may well be, for example, that when we get to level 5, or even level 4, a lot of those vehicles are not sold in the way that they are sold today. A new electric vehicle was launched a couple of weeks ago by a new brand called Polestar, which is owned by the same people who own Volvo. They say that the car will be sold on a subscription model, so it would remain within the possession of the manufacturer.

There is a lot of road to cover between now and then. Whoever is looking after those cars—I have already talked about electric cars, but when we get to autonomous cars as well—they will still have accidents. Things will drop on them and things will happen to them that are not caused by the car. When they are repaired, we have to be assured that they are repaired to a standard that returns them to exactly the same capability they had before the accident, which means we need people who are certifiably competent to do that. That is where we are interested in seeing some clarity.

We have cars with quite substantial autonomous capabilities already—Tesla is a good example—and I have seen second-hand examples of them that have

gone beyond the dealer network. You have to wonder about the competence of the people who will work on that car—I am not saying that they are incompetent, but I do not know that they are competent. When someone next engages the autonomous capabilities of that car, will they do the things they are supposed to do? We cannot just leave that to chance. We have to be sure that there is some way of assuring ourselves about the people who work on them. This is not like the days when there was somebody who was “a bit handy”, as I think the phrase used to be, and you could give your car to them and they could look after it. This is a paradigm shift. We need to move with that and recognise that these cars, even though they have four wheels and look a bit like the cars that we have today, are entirely different. The skills base needs to be elevated to deal with them because they are an entirely different prospect.

Q112 Rosie Duffield (Canterbury) (Lab): If there was one aspect of the Bill that members of the panel could change, what would it be?

Brian Madderson: The mandating of motorway service areas and large fuel retailers should be taken out at this stage because the market is just developing far too rapidly. We have even asked the Department for Transport what the definition of a large fuel retailer is, and it has said that it does not know yet and it will consult on that. Is it the size of the plot of a single one? Is it a multi-site organisation that might have filling stations all over the UK? Is it the amount of existing fossil fuel that a retailer is supplying? There is no definition, so I do not think it is reasonable or fair to mandate a large fuel retailer when you do not know what that is.

For similar reasons, I do not think that is fair and reasonable for motorway service areas either. There is just no money in it at the moment to justify huge investments, but there will be at some stage in the future and that is when the market will be able to say, “Let’s move on this now, and quickly too”. Hence my plea that the planning authorities are fully engaged to be able to allow effective planning applications as and when they are required for charge points.

Steve Gooding: Rather than changing something in the Bill, I think we would say that the powers—particularly in relation to electric vehicles—are drawn quite broadly. We would like to see how they are going to be used in succeeding regulations. We published some suggestions on how they might be crafted. There will obviously be some concerns—Brian’s perhaps first among them—about the implications for the operators of service areas, for local authorities and for householders. We would like to see the detail and to be confident—as I am sure we are—that the Department will get it right.

Brian Madderson: I would come back to that and say that the RAC’s report suggests that forecourts—filling stations, as they are at the moment—are probably one of the least best places to put a bank of charging points because of constrained space and alternative use, and because the few that we have today are all pretty busy selling diesel and petrol.

Steve Gooding: Apart from motorway service areas.

Q113 Craig Tracey (North Warwickshire) (Con): Could I just follow up an answer you gave earlier, Mr Wong? You talked about the Audi model of traffic jams, where a car will offer to take over when a series of conditions are met. Is that how you see this working in the short term? Is it phase four?

David Wong: Level 3.

Q114 Craig Tracey: My question is: if one of those conditions is not met, then you said that it will invite the driver to take back control. What happens if the driver either does not or cannot take back control? How quickly would that process need to happen? Given that, why does that not give the potential for there to be more accidents in the short term?

David Wong: In the first place, the limiting conditions are such that the vehicle can only operate under the traffic jam pilot functionality at 38 mph, so that is a relatively low speed. If the driver is required to take back control at that low speed, Audi has said that there will be a minimum period of 10 seconds for the hand back to take place at 38 mph. This is completely different from some of the things that may have been heard in the press, where people were saying, “Oh, at 70 mph there is a three to five second hand back, it’s impossible to do that.” It is perhaps impossible. Audi will have a minimum hand back period of 10 seconds at 38 mph.

If the driver still fails to react within those 10 seconds, then a minimum risk manoeuvre will be performed whereby the car will slow down and grind to a halt in the lane safely, flashing the emergency indicators and strapping the seatbelt tight across the driver. The driver might have passed out, or may have become incapacitated. That is the assumption. In the intervening period, there would be a series of warnings within those 10 seconds including visual, acoustic and eventually haptic warnings. So there will be lots of measures that Audi has in fact built in. In any case it is travelling at 38 mph, so it is perfectly possible for the car to gradually grind to a halt in the lane with those measures in place.

Steve Gooding: Some of us are entirely unpersuaded that level 3 makes any sense at all. I accept all of the reassurances set out by David, but you should consider for a moment the Department for Transport’s own research showing that you are much more likely to kill someone when travelling at 30 mph than at 20 mph. I wonder if, at 38 mph, the window being created by Audi in which its system can operate is going to be too narrow. I am not sure that I have ever seen a dual carriageway in an urban area that is free-flowing with clear signs in this country. I think, personally, that we ought to say that level 3 is something that we do not want.

Q115 Stephen Kerr (Stirling) (Con): In connection with what has been discussed today in relation to these five levels from manual to automated: in the context of the Bill, is the definition of “automated” in the Bill adequate for the purposes of the Bill at this point?

David Wong: We are informed that the policy intent behind the Bill is to do with the new insurance framework—the single insurer model framework—to cover level 4 and above. Insofar as that is reflected in the spirit and letter of the Bill, then that is adequate because it is at level four that the human being is—technically speaking—out of the loop, to use engineering parlance. The human being has surrendered control to the vehicle. At anything below level 4, the human being is still technically responsible and in the loop. So for these purposes the Bill is adequate.

Q116 Stephen Kerr: So there is no need to delineate the different levels and so forth within the Bill.

David Wong: From an industry perspective it is always helpful if the levels are spelled out very clearly in the Bill. Our understanding is that it is rather unhelpful to spell out levels.

Steve Gooding indicated dissent.

Stephen Kerr: You are shaking your head.

Steve Gooding: I would say that the definition in the Bill is adequate because of what David has said. It contemplates a world in which the vehicle can operate in autonomous mode without the driver being responsible. That is fine. It does not facilitate level three and that is fine too.

Q117 Sir Greg Knight (East Yorkshire) (Con): Do you think that there is a case for the Government to introduce rules requiring the providers of these electric charging points to have to advertise the price they are going to charge the motorist, with the price visible before the vehicle actually parks up to the charging unit, as it has done for autogas, petrol and diesel sales?

Brian Madderson: I have no problems with that.

Q118 Sir Greg Knight: It is necessary really, is it not?

Brian Madderson: Yes. It is definitely a good idea. We do that all round—on autogas, diesel, petrol, super-unleaded or whatever it might be—at the present time. The price is displayed, and I think it is a fine idea to do that with electric charging as well. It must be said, however, that since April 2016, when some of the charging point providers moved to pay as you go, the demand on motorway service areas for those chargers has dropped by 50%.

Q119 Matt Western (Warwick and Leamington) (Lab): I was interested in Mr Madderson’s point about not mandating. The car industry has often reacted well when it has been mandated to do things; when things such as Euro NCAP were introduced, it followed suit and made dramatic improvements. Given the ambition of the Government and across all parties to see more adoption of ultra low emission vehicles, and given that markets such as Norway’s are much further ahead than ours, what should we be doing to ensure that we are in a leadership position in electric vehicle technology?

Brian Madderson: It is also about providing the carrot by way of funding. That is going to be the big spur to encourage firms, in a rapidly changing market, to take that investment decision and to ensure that such decisions are supported by their banks, lenders, shareholders and others. At the moment, you do not appear to be mandating hotels, leisure centres or workplaces, all of which are admirably fine locations for charging points; you just seem to be mandating motorway service areas and large fuel retailers, whatever that description means. We do not think that is fair, reasonable or necessary.

Q120 Sir Oliver Letwin: I just want to clarify something that Steve Gooding said. Why do you think that it is clear that clause 2(1), which refers to “an automated vehicle when driving itself”, applies only to level 4? Why does it not apply to level 3?

Steve Gooding: I am not a parliamentary draftsman, so I would have to be reassured about this, but to me “when driving itself” means that the driver of the vehicle is not legally responsible for the vehicle; the vehicle is driving itself. That is what I intended to convey.

The Chair: Thank you very much for your attendance today and for your answers. We are very grateful.

Examination of Witnesses

Marcus Stewart, Robert Evans and Suleman Alli gave evidence.

2.54 pm

Q121 The Chair: We will continue our session by hearing oral evidence from National Grid, the UK Electric Vehicle Supply Equipment Association and UK Power Networks. Will you please introduce yourselves and say where you are from?

Robert Evans: I am Robert Evans. I am chief executive officer of Cenex and chair of the UK Electric Vehicle Supply Equipment Association.

Suleman Alli: Good afternoon. My name is Suleman Alli. I am director of strategy for UK Power Networks. We distribute electricity to 8.2 million homes and businesses in the east of England, London and the south-east.

Marcus Stewart: Hello. My name is Marcus Stewart. I am head of energy insights for National Grid. We are responsible for the balancing of the electricity and gas networks, and for managing all the energy across the UK.

Q122 Karl Turner: On charging infrastructure, we have just heard evidence from the Petrol Retailers Association, which is very worried about being mandated to have charging points on the forecourts of its members. What is your prediction of what would happen if we did not mandate them to do that? If it was not required by law physically to invest and have them on their forecourts, would they bother?

Marcus Stewart: At the moment, the majority of people who own electric vehicles charge them at home, but there is a limit to how many houses have off-street parking. About 43% of properties do not have access to off-street parking, therefore other forms of charging facilities need to be available. They could be a mixture of charging types at destinations, workplaces, supermarkets, and so on.

From the evidence that we have gathered when we have talked to and interviewed people, key locations on the motorway and strategic network are seen as key enablers for the roll-out of electric vehicles and will help to remove some of the concerns around range anxiety which is seen as one of the main barriers to the take-up of electric vehicles at the moment. Charging and plus charging in particular at key locations across the country will facilitate the roll-out. If you do not have that, it is likely that the roll-out will be slower.

Suleman Alli: I support that. I would say that there is going to be a paradigm shift. It is a bit like when we used to get water from a well and we now get it from a tap in our home. In the same way, I do not think that petrol forecourts will be the only place where we will recharge our vehicles in the future. In our engagement with the marketplace, we are seeing major supermarkets looking at how they can offer fast charging to be a key differentiator for their customers. We are seeing hotels considering the same and local authorities looking to explore how on-street charging can be part of the solution. Based on the engagement we have done, I believe that it will be a much more diversified charging environment: it will not just be petrol forecourts.

Robert Evans: We have members who are very interested to install charge points at these locations. They see them as locations where there will be high utilisation rate and a good economic case for those charge points to be used. We are also talking here about an insurance policy—it is not a mandating per se. If the market does not deliver, the Act gives Government the ability to step in. It is not by definition a mandating until you pass additional legislation.

The members are very interested in installing in these locations, but they are other people's land. Part of the issue here is the ability to encourage landowners to install charge points at their locations. In some cases it is a fuel supplier, in other cases it is one of the three main companies that operate motorway service areas. You have to recognise that there is a desire to install in those locations, but you cannot put your asset on someone else's land.

Q123 Sir Oliver Letwin: I am delighted to hear what you say and absolutely agree with you. If the problem of range anxiety is addressed or partially addressed by fast charging at service stations and so on, we are still left with—I think you said—40% of homes that do not have off-street car parking. Have you done any assessment of the kinds of costs involved for the distribution network operators if over the period between now and 2040 there was a roll-out of universal charge points on the street in towns and cities—probably not all areas—where there is lawful parking?

2.59 pm

Sitting suspended for a Division in the House.

3.11 pm

On resuming—

The Chair: We are now quorate. Sir Oliver Letwin asked a question, which you of course have remembered exactly, and you may now answer it.

Robert Evans: I think your question related to the aspect of there not being so many people with off-road parking, so how do you make provision available for them? Certainly in this city, in London, that is an issue. It is also an issue in many cities across the UK. The availability of charging infrastructure in supermarkets, shopping areas in market towns and leisure facilities is certainly helpful, but obviously if you do not have home parking you are at a disadvantage compared with other motorists. So it is partially self-selecting, in a way, but certainly in London and other locations if you have a certain amount of public infrastructure it will help those people who want to buy an EV to have one.

Q124 Sir Oliver Letwin: Have you looked at the cost associated for a DNO in London, say?

Robert Evans: From our perspective, no, we have not. We know that UK Power Networks have done extensive study work in their projects, and we know from dialogue with Western Power Distribution that they have also looked at the same. Some of the councils here in London—for example, Hammersmith has a scheme that is looking to leverage the street lighting—

The Chair: Will you speak up a bit, please?

Robert Evans: Sorry. Hammersmith has a scheme that is looking to leverage the street lighting in order to provide charging for residents on the street. Part of that is largely around civil works and some of it is around the electrical works. The DNOs will be able to advise in these cases whether the low-voltage network needs reinforcing, but otherwise it is predominantly a matter of civils and equipment. Members are developing charge points, and have charge points, that can charge from street lighting, albeit that the power supply to that lighting is limited.

Q125 Sir Oliver Letwin: Has UKPN done an analysis?

Suleman Alli: Yes. It is very difficult to give you a definitive answer on the exact cost. The reason why it is so difficult to do that is that in order to come up with a cost, you have to understand the impact that it is going to have on the network. To understand the impact on the network, you have to understand when people are likely to charge, where they are likely to charge, the amount they are going to charge and the type of charger they are going to use. There are multiple permutations of that.

The only approach that we thought was appropriate to consider was to look at scenarios. Our peak demand across our three networks is around 15 GW. We think that up to 2030, when we might have between 1.2 million and 2 million vehicles, their peak demand could be between 2 GW and 5 GW—so between 10% and 30%. If you think of our track record over the last five years, we have connected 5 GW of distributed generation on our grid. That is equivalent to one and a half Hinkley Point Cs, without much fuss or bother. We have until about 2030 to work out how we are going to do this. My view would be that we are not complacent, but we are confident that we are going to come up with some solutions.

We think the Bill as it is currently presented provides us with a lot of help. In order for us to understand the impact, you need the visibility and the smart charging functionality. If you have the smart charging functionality combined with smart tariffs, you can start actually to deliver the infrastructure at lowest cost. I am sorry that I do not have an exact number for you. Anyway, if I did give you a number, it would 100% be wrong—but we are doing a lot of modelling and work to understand what the permutations are.

Q126 Sir Oliver Letwin: Have you looked at the other side of the coin—the peak locked-in capacity of the cars that are attached at a given time of day, say in the mornings or evenings, that could be used as a sort of battery resource?

Suleman Alli: That is a really exciting area of development at the moment. We are looking at it. As part of the Innovate UK funding, we are going to be supporting five EV trials, one of which is including a vehicle to be trialled with Nissan.

If you look at where distributed generation is connected in the UK today, it has mainly been at grid scale. A lot of our research on storage has been focused on grid-scale storage. We commissioned the largest battery in the UK at the time, 6 MW or 10 MWh, and we are very clear that storage can help peak shaving for the distribution networks at grid scale. We think that same concept can be applied to vehicles, but the trials need to take place for us to understand it fully. That is happening at the moment.

Q127 Sir Oliver Letwin: When do you anticipate results from those trials?

Suleman Alli: I believe within the next 12 to 24 months. We are looking abroad as well at other countries to see how we can generate learnings from those trials. Certainly, in the next 24 months we will start to see concrete evidence that we could present.

Q128 Mr Hayes: I wanted to bring up two or three things. The first is that you presumably agree with the changes we made from the first Bill, which was the forerunner of this Bill—the Bill that did not make the cut before the election. You will remember that what we have done this time is clarify the definition of automated vehicles, as a result of previous scrutiny. We have tightened that definition. How important do you think that is in providing confidence to the industry in respect of further developments?

Robert Evans: Automated vehicles are not strictly my area of operation, so I find that that is something that I cannot strictly answer.

Marcus Stewart: In some of the work that we have done when we have projected forward and looked at various energy scenarios, we see automated vehicles as having an impact on total energy usage. More automated vehicles, and clarity around the question, will allow different business models to come forward. Car sharing is more likely as part of that, and that will reduce the overall demand on the energy system, but we believe that it is still quite a long way out—maybe 2030-plus—before we start seeing any significant impact from that.

Q129 Mr Hayes: In terms of electric vehicles, I take it that the availability of a robust charging infrastructure is critical to the further take-up of those vehicles. I know there are other barriers to entry—market price, reliable battery technology and so on—but presumably in your view the charging infrastructure is an important part of encouraging more people to buy electric.

Robert Evans: Yes, absolutely. This is part of a process that the Government have played a key role in seeding—the introduction of charging in key locations and providing support to Plugged-in Places and now to the Go Ultra Low cities and others, to create exemplar projects and to encourage the roll-out of infrastructure. Making that infrastructure visible is a key part of reassuring people that owning an electric vehicle is a good thing. Being able to have a home charger, with support from the Government, that meets very high technical standards is also really important, so that people are not charging their electric vehicle from an extension cable or similar on a three-pin plug, which we would not advise.

The Government have played a very important part in dialogue with industry about the process of seeding. Now we are in a situation where we have more than 100,000 electric vehicles on the road, and the car industry is committing to introduce the vehicles, and so the roll-out of infrastructure is occurring largely with market forces, in the sense that businesses and locations are realising that they need to have charging as part of their offer. If it is a tourist destination, it wants to have electric vehicle drivers come to its location rather than another one, and so on.

We have good momentum, but it is still really important that where there is workplace charging, for example, we get conversion of people who work at that location because they see that there is charging that they could

use, they start to think and then they buy electric vehicles. We thoroughly commend the Government's workplace scheme, because we can see the catalytic effect that it is having.

Q130 Mr Hayes: Finally, we heard a lot earlier about the development of skills. The point was made across the Committee that we need a co-ordinated process by which we encourage the further development of relevant skills as the technology moves on. What is your thinking about that? Clearly, the industry is doing a lot of work on skills, but how can we more effectively accelerate the acquisition of the necessary skills so that we are not left in a situation where this technology can be serviced at only a very limited number of places?

Robert Evans: Skills is one of those challenging areas where we have a plethora of schemes. I was told that there are currently about 220 different skills initiatives for the motor industry. The challenge is not necessarily to create another skills initiative, but to work out how best to blend the relevant content into existing initiatives. Certainly on the garage side of the motor industry, greater skills or a spreading of skills for mechanics and engineers in terms of them being familiar with and able to operate on electric vehicles would be helpful. There is a general skills shortage in the motor industry, and that is something that training and development at a local level can assist.

Mr Hayes: Thank you.

Q131 Iain Stewart (Milton Keynes South) (Con): Following up on the question asked by my right hon. Friend the Member for West Dorset, I have a question about the capacity of the grid to cope with the expected increase in demand, and in particular the timing of that demand. While researching for the Second Reading debate, I came across an Atkins report that draws on findings from the Energy Technology Institute that peak demand is likely to be in the early evenings—particularly Sunday evenings—and that that could increase demand on the grid by 10 GW, or 20%, at the time when it is least able to cope. Is that a finding that you recognise?

Marcus Stewart: One of the key things that affects the impact on the grid is people charging their cars. Smart charging is absolutely key to mitigating that. I will give you some examples from the work that we have published. We published our "Future Energy Scenarios" report in July. In a high-growth scenario that aligns with the Government's target to ban sales of diesel and petrol engines in 2040, we would expect to see around 9 million electric vehicles in 2030. That would add something like 17% to peak demand, which occurs on a Monday or Tuesday evening in the winter, if there was not smart charging. If there was smart charging and people responded to that through time of use tariffs or other incentives, that could be reduced to around 6%. How people charge and how they are incentivised to do it has a real impact.

At the moment, the technology exists—the charging posts that have been put in have that technology—and we support the measures in the Bill to ensure that all charging points have that capability, which would make a significant difference to how easily electric vehicles are accommodated by the network nationally and locally. Smart charging is absolutely key, and we support the approach in the Bill.

Q132 Iain Stewart: Are you content, given the content of the Bill, that the industry will come up with those incentives itself, or will there be a requirement for further guidance or direction?

Marcus Stewart: I believe that the industry, in terms of energy suppliers, will offer smart tariffs. We have already seen that; OVO has published a proposed smart tariff that will actually support vehicle-to-grid when that becomes available. The market is likely to respond. There are also changes in the electricity market around billing for half-hourly meter reconciliation, which will drive the supplier to optimise their portfolio and to offer similar types of tariff. The mechanisms are there to make that happen. At the moment there are only 100,000 to 120,000 electric vehicles, so there is a very small impact, but when we get to millions of cars, we need to have that smart charging capability. People in the market are seeing that opportunity already and want to participate in that. Having the framework and rules that facilitate that and mandate the technology and infrastructure will go a long way to facilitating that.

Robert Evans: I would just like to add that on the one hand I am very reassured by my colleague's contribution, which recognises that this is a market opportunity and that we have members who are very keen to provide the charging technology and the market mechanisms that would allow a motorist to make their electric energy—their battery—available, so that they do not charge at night, but they can provide power back to the grid when it is needed and manage those smart services.

We are concerned about mandating a specific technology. There is a context around the Bill that says it will mandate a certain technology or approach. We would like to see a recognition of the need to create a market rather than have a situation where, for example, a DNO can effectively turn off charging for somebody because they feel that that is necessary under certain conditions without involving the motorist or without market mechanisms coming in in the first place. We are particularly keen that this paves the way for a market-based approach. We welcome variable tariffs and vehicle-to-grid technology and we see the storage of electric vehicles as exactly what you need in an energy system with a high element of intermittency, as we add more and more renewables. The storage element is going to be a lot more valuable and there need to be market mechanisms to unlock that, rather than a mandated approach that is purely a situation where someone can turn off as they choose to, without the motorist or business—

The Chair: Thank you very much. Alan Brown.

Q133 Alan Brown (Kilmarnock and Loudoun) (SNP): On the smart grid that we are aspiring to, the panel has already alluded to the fact that they think smart charging will come by market, but there is a lot more that the Government need to think about in the wider energy mix, because there is also decarbonisation of heat and further decarbonisation of electricity. There is the future scenario of an influx of electric vehicles, but a whole lot else is going on in the energy mix as well. The point is to make sure that is all captured to get the smart grid we need.

Marcus Stewart: We see smart charging for electric vehicles as a key starting point for that. You can get smart technology in your home today—smart thermostats, for example. Commercial premises have smart air

conditioning and smart lighting that help to balance their load and can provide services back to the grid today. An electric car will be the biggest asset in the home that uses energy, unless you convert to heat as well, and that will have a big impact on the system. Making that smart at the start is the right thing to do.

Suleman Alli: It is a bit like the concept of offset mortgages in the financial services sector, where you pay your salary into an account and that offsets against the mortgage interest you pay. We are starting to see a new business model emerge where people say, “We can give you price certainty or reduced energy bills if you plug your vehicle in and allow us to provide services to the wider network operators or the system operators.”

I think the market will innovate and start to provide those services. We are already seeing that in the internet market, for example. Some of the trials we are doing will look exactly at that area. It is intuitive for us to think that if you have an electric vehicle you are going to go home and plug it in straightaway. The research that we have undertaken shows there is a diversity. When you have a large population of EVs, not everybody goes home and charges at the same time. In fact, we have seen about 30% of the impact materialise—of the capacity of charge that has been installed. There is an element of diversity that we incorporate into our planning that is based on evidence from the trials we have undertaken.

Q134 Alan Brown: Can I ask one more question about the model scenarios? You are modelling how many vehicles might be coming in, among other things. Is that based on mass volume modelling, or does it look at existing restrictions in the network and at where the uptake might be? Clearly, uptake depends on the roll-out of the charging system and some local authorities in some areas are much more at the forefront of that than others. That potentially impacts their work as well.

Marcus Stewart: I could talk about how we would do that. The primary reason to do it is to understand what network capacity expansions and reinforcements are needed on a national level. We will have different assumptions for different locations, where we have evidence. For example, there may be clustering in cities that we will make assumptions around. I imagine that the DNOs will look at similar things for their networks as well. We look at it on a spatial basis; it is not just a single-number basis.

Suleman Alli: What we are looking to do, particularly with electric vehicles, because there is a lot of data available out there, is try to apply much more advanced analytic techniques. For example, how can we marry up Land Registry data, which gives an indication of people who might have driveways, together with Acorn data about people who might be more able to buy an electric vehicle, together with data on charge points, in order to get a better and more granular view of our network? That is what we are doing at the moment to improve our planning.

Q135 Alan Brown: So it is a live, ongoing process.

Suleman Alli: Absolutely. I do not think we can ever say we are done.

The Chair: Thank you. We have a lengthening list, so let us have one question and one answer.

Q136 Stephen Kerr: Are there global standards within the industry for the connections between the cars and the charging equipment? Is there a global standard for

the charging equipment? Should there be a universal way of connecting, so that you do not travel somewhere and find you cannot plug your car in? Should there be a railways gauge Act for electric cars, so that we get that uniformity?

Robert Evans: There are standards. There has been a difference between a Japanese product coming to a Japanese standard versus a European product coming to a European standard. Charge points typically have several connectors to accommodate different vehicles. That has been the simple solution.

Q137 Stephen Kerr: Should there eventually be one?

Robert Evans: I do not know that we in the UK can necessarily say that this is the charger that is required for the global motor industry to produce. In the past, the Office for Low Emission Vehicles has set grant funding regimes that encourage particular types of charger because they are better for safety and for the motorists' general use. That is to be commended.

Q138 Stephen Kerr: You do not see legislation playing a part in this?

Robert Evans: At this stage I would say that was not necessary.

Q139 Scott Mann (North Cornwall) (Con): A couple of my questions have already been answered. One was on the car-to-grid technology and the other one was on peak capacity. I want to ask the National Grid this: does your grid mirror some of the main arterial roads that run through the country? How effectively could you put your grid capacity into locations? I am firmly of the view that we should not necessarily assume that we want all the charging points to be in current service stations—there might be opportunities outside the existing ones—so how easy will it be for you to deliver that with your current grid locations?

Marcus Stewart: The high voltage network does mirror parts of the motorway network, but not all of it. There will be locations where there is a clear opportunity to build a connection for high voltage to supply charging, and there will be other locations where it is just not that simple. It has to be looked at on a case-by-case basis. Some of the options around that are maybe connecting at a lower voltage tier but using onsite storage, so you are not taking too much stress from the grid in one go. You are managing exactly the same as a petrol station does today, where it fills up a tank of petrol under the ground and feeds it to the cars as they need it.

We have talked to different developers and people who are looking at those kinds of options, and we describe it as a sort of mosaic of different charging routes out there. One of them could be high voltage input, with 350 kV of charging, backed up with a megawatt-scale battery to minimise the connection to the grid and that impact.

Q140 Scott Mann: I have one small supplementary question, if I may. Do you see yourselves as being an end-to-end provider or do you see other companies coming in to fill that middle gap?

Marcus Stewart: From a national grid point of view, my role is to balance the network and ensure that the energy is balanced. We have a transmission owner part that would own the high voltage network, and certainly the element up to a connection. Anything beyond the

connection is available for third party competition. Any service provider could put that in. A deregulated version of the National Grid or another third party could put that in. Our primary role is the reinforcement element upstream to support that.

Q141 Mr Hayes: On the back of that, between you there is immense expertise in managing complex systems—I have read your CVs. On the issue of grid management, earlier today we heard a call for some kind of co-ordinated approach on where charge points were located to ensure their spread, and to ensure that there were no areas that would become black holes where there were not enough charging points. Presumably, any such co-ordinated plan would need to be married to the supply of electricity via the grid. The Bill does not yet do this. It is a first step down this road, and it simply increases the number of charging points. Do you see the sense of putting together a co-ordinated national strategy that ties together the provision of the charging points with the provision of the power?

Marcus Stewart: I think it would have some merits. I am not sure whether it needs to be mandated or not.

Q142 Mr Hayes: I was not necessarily suggesting that it ought to be mandated; I was simply arguing that it might be facilitated. There could be a co-ordinated approach that might facilitate—this is the word that was used earlier—both the provision of charging points and the other considerations.

Marcus Stewart: It certainly makes sense to look at where there is good capability on the local or national network, and to consider that in respect of good accessibility for people; for them to be able to come in, connect and charge up their cars. I would expect those to be offering the early take-up points. Effectively there would be a least cost route to getting fast charging points delivered, in particular. A number of parties would have to come together and look at those opportunities: the National Grid, local network operators, charge point owners, service station owners and people like that. That would make sense.

Q143 Matt Western: I was interested in what you were saying about the workplace uptake, the conversion and how it switches people. Do you think we are doing enough—with all the housing developments and the local plans being put in place across the country—either to mandate or to encourage a rapid and widespread adoption of electric vehicles?

Robert Evans: The answer is no. We are not doing enough.

Q144 Matt Western: What could we do?

Robert Evans: Two different things. One is that the size of the power cables running into new developments is typically capped by the developer or by processes, so it is not built to add further capacity at later dates. That is what charging would require, so that is one part of the equation. The second part would involve effectively putting wiring in new homes in such a way as to ensure that a charge point could easily be added. We have repeatedly asked about this but been told that even putting a smoke alarm in some houses is too much for some developers. Any additional input in that area would be very welcome.

Q145 Matt Rodda (Reading East) (Lab): Air quality is a huge issue, particularly in many urban areas and some other parts of the country. What do you believe

could be done to increase the roll-out and take-up of electric vehicles in urban areas to help tackle the problem of air quality?

Suleman Alli: From our market, first we need to engage with people to talk about range anxiety. It is down to motor manufacturers to produce vehicles with a longer range. The second thing is availability of charging infrastructure. We have certainly seen an increase in activity from both TfL and local authorities in wanting to understand that more effectively, and we have done a lot of engagement with local authorities to demystify the process and explain what the costs are likely to be. The third thing is just the up-front cost—the capital cost—of buying a vehicle. There is no silver bullet; we would need to do a range of things to increase adoption.

Q146 Matt Rodda: If you do not mind, I will ask a brief supplementary question. Those points all sound very valid, but they may apply to the whole country. Are there specific measures that you would suggest the Government ought to be considering for urban areas?

Suleman Alli: In urban areas, where people do not necessarily have a driveway and perhaps live in flats, they have to have provision of charge points on the street for on-the-go charging and destination charging—at railway stations, supermarkets and so on. In urban areas you would need to identify those locations—car parks and so on—that have the space to provide destination charging. In that case, it would probably have to be rapid charging to provide the charge that you would need.

Robert Evans: We would be very keen as an industry to work more closely with the DNOs for the roll-out of the charge points, but also the grid reinforcement needed to get charge points in strategic city locations. For example, London, with UK Power Networks, has provided support that has effectively created locations where the power is available for rapid chargers to be deployed. The same is happening in other Go Ultra Low cities. We would like to have a partnership approach whereby we could work with the DNOs in particular cities to make sure that we could get infrastructure in strategic locations. *[Interruption.]*

The Chair: Given that there is now a Division, I think we can let you go, because it would be unfair to keep you. We will start straightaway in 10 minutes with our new set of witnesses. Thank you.

3.41 pm

Sitting suspended for a Division in the House.

Examination of Witness

Quentin Willson gave evidence.

3.53 pm

The Chair: We are now quorate, so we can hear from Clive Efford, but first I should say to our witness, as I do not want to be rude, that perhaps you should introduce yourself.

Quentin Willson: I am Quentin Willson, motoring journalist and television presenter, who has been an electric car advocate for the last seven years. I advise and help OLEV and Go Ultra Low, promoting electric car use among the public. I have done 50,000 miles under the wheels of electric cars over the last seven years, and my day-to-day car is a Nissan Leaf.

Clive Efford: You certainly look good for having done 50,000 miles “under” the wheels.

Quentin Willson: Absolutely!

Q147 Clive Efford: Anyhow, this is about automated vehicles. When automated vehicles and conventional vehicles share the roads, will the question of who is liable for accidents become more complicated?

Quentin Willson: Enormously complicated. It is not my area of expertise, but the question I would ask is: can they co-exist peacefully? Can the connected and the unconnected in the UK’s very limited road space exist? Can those cars that drive themselves be allowed to co-exist with the cars that are driven by human beings? Will there necessarily be some friction during that period? I think that in the short to medium term, it is going to take some time.

Q148 Clive Efford: Do you think that the legislation goes far enough on that? Do you think that there should be more in the Bill?

Quentin Willson: I think we need to be very careful that we know exactly who is liable, because there will be quite a few accidents, whether it is the manufacturer, driver, network provider or road provider. It has to be established very early on.

Q149 Clive Efford: Can I move on to this issue about the transition from automated vehicle to a person taking over? We have heard various descriptions about the length of time that might take. You say that we need to be clear about the moment that the driver becomes responsible and the software is not, but is there an issue around safety caused by that transition?

Quentin Willson: Inevitably you will get a feeling of complacency, of reliance on the technology, and if there is an emergency situation or you leave the automated road system to the non-automated road system, you will have to have that moment of what we call extreme alertness. Consumers need to be trained for that and we need to be ready. If that is a legal transitional moment, where you take the wheel having been driven autonomously, that could be an issue as well.

Q150 Clive Efford: On the moral issues that are raised by algorithms that control these vehicles at a time when there is an accident, a scenario I used earlier on was that of a child stepping out in front of an automated vehicle, and to the left there is oncoming traffic and to the right there are pedestrians on the pavement. How do you legislate what you require of the vehicle in those circumstances?

Quentin Willson: I do not think that artificial intelligence will ever be trained to be able to make those moral decisions, and when we take a driving test we are not trained to make them either, so it is a difficult area to think we can resolve. Can we ever expect artificial intelligence in an automated car to make that split-second moral decision between the child in the pushchair or the old people in the Nissan Micra? I do not think we can. We are not trained to do that and we cannot. It is a split-second thing that happens and legislating for it would be enormously difficult.

Q151 Clive Efford: So what will happen?

Quentin Willson: I am not an expert on artificial intelligence in cars at the moment, but it will be, depending on the sensors, the object that has the least resistance.

Q152 Clive Efford: I will leave it there. One last question on what is driving this forward—that was not an intentional pun. Is it the desire of companies that employ large workforces that drive vehicles which are striving for automated vehicles, or is it the demand from the public, which wants to sit comfortably behind the wheel and not have to think too much for long journeys?

Quentin Willson: It is driven, I guess, by the fact that there is a huge world of opportunity here and that is predicated on the fact that people do not like driving anymore—there is congestion, it is expensive and it is difficult—and on the rent economy, whereby you summon an automated car on your smartphone and it comes to your door. When you look at the research, that is very attractive to the public. The golden era of getting pleasure from driving cars has gone, and I say that with some regret, but it is a fact. There was a survey by Catapult in Milton Keynes which asked this question: if you were to replace your current car with an autonomous car—we are not going to tell you what it is or what it looks like—would you be prepared to change to that autonomous car? Some 58% said that they would change to the autonomous car without knowing what it was, simply because of the liberation of not having to make those decisions and sit impotently in snarling traffic. It is partly driven by commerce and partly by the public.

Q153 Alan Brown: Is the Government’s target of 2044 for zero-carbon new cars ambitious enough?

Quentin Willson: I sat before this Committee a year ago and was broadly optimistic about the short and medium-term future of electric cars. I think Michael Gove’s announcement in July, coupled with Sadiq Khan’s T-zones and ClientEarth’s relentless pushing on air quality issues, has terrified consumers. It has wiped probably £30 billion off the value of diesel cars. Lease companies are now looking at a collapse in the residual values of the cars that they lease to consumers on personal contract purchase. We are looking at a real issue in the short to medium term.

The consumer now feels that he or she cannot buy a diesel car; we have seen sales of diesel cars absolutely collapse over the last quarter. They are feeling, “Right, I’ve got to buy an electric car.” We need to manage their expectations. I am quite concerned that people who rely on one car as the family vehicle will go out and buy, like me, a second-hand Nissan Leaf for £10,000. That is great, but we must understand that those cars’ ranges are nowhere near viable for an everyday, use-it-all-the-time car. They are a wonderful urban solution, but long journeys—anything more than 100 miles—are really difficult. I came down here in an alternative car; I had to leave my Nissan Leaf at home, because getting here would have required three stops to charge.

It is about managing consumer expectations. Otherwise, this whole thing will go horribly wrong. The new Nissan Leaf, which I saw in Oslo last week on its launch, has a quoted official figure of 235 miles to one charge, but the Nissan engineers tell me that in reality, it is 175 miles for everyday driving. If you drive that car on the motorway at 70 mph, that will fall to about 130 or 140 miles. The technology of the lithium ion battery still has some considerable work to do.

Again, it is all predicated—the mass adoption of electrification in the short to medium term—on having better battery density, maybe of alternative materials

such as graphene, and a very robust charging infrastructure network. I am not talking about on-street chargers; I am talking about charging hubs like petrol stations, with 20 rapid chargers that can charge 20 cars in 40 minutes. That is the only way that mainstream consumers will be able to do any form of distance. They are wonderful for town work, but if you are doing more than 100 miles, you are still compromised.

Q154 Alan Brown: To follow on from that, it is interesting what you say about the conundrum of managing consumer expectations so that people do not buy a vehicle that might not suit their purposes. Going forward, when the technology allows, given that it was UK Government policy that drove the flux of diesel vehicles, does there come a point when the Government should incentivise a diesel scrappage scheme to get that mass ownership?

Quentin Willson: I would rather spend that money on the NHS. Here is an irony: we talk constantly about air quality, but in the MOT, there is no proper smoke test, although it is called a smoke test. The particulates come out the back, and the MOT examiner will fail the car if it loses rearward visibility. If you cannot see out the back when the car is accelerating, it fails. That is why you see all these cars puffing out black particulates. If we stiffened up the MOT with a proper particulate test and then automatically scrapped these cars, a lot of which are old and worn out and pollute much more than we realise, we would not have to finance a scrappage scheme. Consumers would realise, “This car is knackered; it’s got to go anyway.” But at the moment, there is no mandate against either petrol or diesel cars that really pollute.

Again, on the air quality debate, I am not sure that we will solve urban air quality with electrification alone. Even though we get massive amounts of people driving electric cars in cities, we still have 30% of particulate and NOx from industrial combustion, 20% from domestic combustion, 14% from ground machinery such as diggers, trucks, dumpers and cranes—these are London Assembly figures—5% from HGVs, 8% from vans and 9% from buses. We do not know the contributions from aviation and shipping. Certainly in London, with 20 million tonnes of stuff coming in on the Thames tidal, the fact that that is not even quantified worries me greatly. We do not want the unintended consequences of this not to affect air quality significantly and, in the meantime, blow the GDP of a generation while doing it. That is my worry. The fact that we do not know enough about this, and that it is being pushed and pushed and terrifying consumers, is of great concern to me.

The Chair: Thank you for that admirably clear answer.

Q155 Rosie Duffield: You talked about getting drivers behind this because they know it is the right thing to do, and that drivers are frightened. We are also trying to meet the environmental targets that the Government have set. Knowing car enthusiasts as you do, do you think that people will ever feel as enthusiastic and fanatical about electric vehicles as they do about Ferraris or other exciting cars?

Quentin Willson: That group of car enthusiasts is quite small now. It is a very small percentage of the market. Most of us just see the grim business of getting from A to B as a necessity. As I said earlier, the idea of the open road with your Porsche 911 is a golden age

that has passed. The Tesla P100D is the fastest accelerating car in the world. It does nought to 60 in 2.4 seconds. It is faster than a Ferrari, which is great. But in terms of mainstream electric cars, I think it will be a while before your hardcore car enthusiast really likes them. We have a big Clarksonsque blockage here—he does not like electric cars or the people who drive them—but I think he is an irrelevance and so are those car enthusiasts.

Our concern should be mainstream consumers who have to get to work, to school, to the shops and to hospitals. We have to make it easy, effective and inexpensive for them but also give them that range. Until we get rid of range anxiety through better infrastructure and battery technology, that will not happen. What will happen is that they will buy hybrids that will do 20 or 30 miles on electric but the rest on petrol. That does not really solve the problem, does it? The people in the Mitsubishi Outlanders who hog all the charging stations will do maybe 20 miles on electricity and the rest on petrol. Again, that is something we need to manage. We need to look at the far reaching, perhaps unintended, consequences of the decisions that we are making now.

Q156 Mr Hayes: Thank you for coming again; you will remember that we had an exchange when you came to the evidence session on the previous Bill. One would accept your view that we will not switch to electric vehicles overnight. Clearly, we do not want to eliminate the use of older classic vintage vehicles—my right hon. Friend the Member for East Yorkshire challenged me on that on Second Reading—but surely there is a good case for taking advantage of the improved battery technology, the greater affordability of electric cars as volume grows, the smoother ride that they give, and their many other virtues. I do not claim that electric cars are nirvana, but given that this will not happen just like that and some allowance will need to be made for the older vehicles that my right hon. Friend champions, surely you acknowledge that it is likely to happen and in the end it is quite a good thing?

Quentin Willson: I agree. The older classic cars are a tiny proportion and their emissions are a raindrop echoing in an ocean because they are used so seldom—some for only 200 miles a year. We should not worry about them.

Mass electrification is coming, but until I see a step change in battery technology, we will not be able to give consumers the beatific vision of 300 to 350 miles to one 40-minute charge. Will that come by 2040? I do not know. You have heard from the car manufacturers. Will we be able to accelerate that technology? It is good that the Secretary of State for Environment, Food and Rural Affairs has given the 2040 cut-off date, because up to now they have broadly been compliance cars made to keep emissions down for EU regulations. Manufacturers will be throwing everything they can at developing batteries, but someone like Jaguar Land Rover does not really have any electric product at all, and Mini has only just scrambled together one electric Mini that does not have a brilliant range. They have a lot of work to do to get to that level. It has taken us 100 years to get to the efficiency of the combustion engine as we have it now. I know innovation is not linear and it will start to climb up, but we need to understand that if we do not give consumers that 300 to 350 mile range, it is going to be very difficult. You see Teslas strolling down the motorways, because they do 250 miles to one charge. That is great, but you never see a Nissan Leaf—think about it.

Q157 Mr Hayes: Let us follow the logic of your argument. I agree the battery technology is a key determinant of take-up, as you described. Clearly, capital prices are a big issue too, and we have supported that over some time, but we acknowledge that until we get volumes up, prices are unlikely to fall significantly, in the way you describe. The third thing is the charging infrastructure. Confidence about being able to recharge on long journeys is critical to people's acceptance of the technology. We have agreed that the move to electric is rather a good thing and we excluded the tiny number of vintage vehicles and classics. Do you acknowledge that the Bill is at least a step towards that? It begins to put together a framework of legislation when it takes account of infrastructure that will at least deal with one of our three shared perceptions about barriers to entry.

Quentin Willson: Completely. We have a lot more consumer awareness to do. I will be doing events with a shopping centre group across the country where we have consumers coming and they have test drives of all these electric cars, plus everything you ever wanted to know about electric cars but never dared to ask, on stage. Go Ultra Low and OLEV do great work; I think we could do even more, but we could also incentivise universities to come up with technology. Danny Alexander and I talked about a battery prize of £10 million. Let us make it £50 million for the real world-class development of a battery that is lightweight and not dependent on rare earth metals. Half the cobalt in the world is in the Democratic Republic of Congo—that terrifies me.

If you can come up with the technology that creates this new, wonderful, miracle battery, then we lead the world and a lot of these problems just disappear, but we need to accelerate that process. The two things—the infrastructure and the battery technology—really need to run, because at the moment we are running too fast with this, because the technology is lagging behind. It is absolutely laudable that we do what we do and put the legislation in place and prepare consumers, but we have to make sure that that technology can support long journeys.

I am afraid you cannot expect consumers just to charge at home at night. They cannot do it. They will want to make journeys. This morning I got into my Nissan Leaf; I had 80 miles on the charge after an overnight charge. It was cold, so I had to defrost the windscreen and put the heater on. I took my daughter to school. The charge went down to 55 miles. If I wanted to go anywhere else, I would have to stop at the end of the 55 miles and charge for 40 minutes, if I could find a rapid charger. If I could not, I would have to do two or three hours. Realistically, we cannot expect consumers to do this in the short to medium term.

The Chair: Thank you very much for your evidence, Mr Willson. As the owner of a beloved 25 year-old BMW, I am grateful that classic cars have a future. Sir Greg Knight will be even more grateful as he is the owner of several vintage cars.

Examination of Witnesses

Denis Naberezhnykh and Stan Boland gave evidence.

4.14 pm

The Chair: Welcome. Would you like to introduce yourselves, please?

Stan Boland: I am Stan Boland. I am the CEO of a start-up company called FiveAI. We are building a driverless car system, which we hope to trial in London by the end of 2019.

Denis Naberezhnykh: My name is Denis Naberezhnykh. I am head of ultra low emission vehicles and energy at the Transport Research Laboratory. We work with industry and Government to help to introduce new technologies such as electric and automated vehicles.

Q158 Karl Turner: I have one really quick question on safety. What are the safety implications for blind pedestrians, runners and people of that nature?

Stan Boland: Safety is the start and finish of whether we can bring these cars on to the streets. A huge amount of attention will be focused on making these vehicles safe, in our case, for use in urban environments, where we will have all sorts of obstacles and agents with all sorts of different behaviours. That really centres on having systems that are able to perceive what is in the scene accurately in 360° and three dimensions and classify what those objects are.

This also talks to predicting what will happen next. We actually have to predict human behaviour, and we have to learn what those behaviours might be ahead of time. Our vehicles will certainly have to be state of the art for perception, but they will also have to be very good at predicting human behaviours. In the case where we identify an object and can tell, just like a human can, that this person, cyclist or whatever it turns out to be has a certain type of behaviour, we will have learnt those ahead of time, and if we are not sure, we will have to propagate that uncertainty through our software and slow down.

The behaviour of these vehicles will be slightly different to that of human drivers, but it will be possible to attain the levels of human safety, and in the long term surpass them, by applying technology. Our systems can pay attention in 360° all the time, and that makes it a bit different to human drivers.

Q159 Clive Efford: What will be the limit of the speed that your vehicles can travel at in an urban area?

Stan Boland: We are kind of hoping that we can operate at normal driving speeds. To be able to do that, it is important that we can predict behaviours. We cannot have a system that is collision-avoidance only, because that would result in frozen robots all over the city and would make congestion worse. What we humans do is anticipate human action. We actually run more than one world in our heads, and are constantly looking to see whether that world is turning into reality or some other world is going to happen. That allows us to merge on to full lanes of traffic, for instance. We cannot just have a system that is collision-avoidance only, because we would make traffic worse. The idea is that we are operating in normal streets with normal road signs at normal road speeds and obtaining and exceeding human levels of safety.

Q160 Clive Efford: In 2019, your vehicles would be the only automated vehicles on the road.

Stan Boland: At that point it is a trial, so there is a safety driver in the car. The safety driver is able to take control of the vehicle immediately.

Q161 Clive Efford: Immediately?

Stan Boland: Yes. The safety driver has to be there, literally able to take control of the car instantly.

Q162 Clive Efford: All the research that I have seen in preparing for this Committee shows that there is a time lag in the transition from the vehicle being under automated control to being under driver control. Your vehicles will not have that.

Stan Boland: You are describing what is called level 3 autonomy, which is a system where the car is under automated control and then there is a warning to give a human driver time—there is a debate about what that warning time should be—and then the human is meant to take over. We think that system is intrinsically unsafe. It is much better if either the human is in control or the system is in control—that is a fully automated, level 4 or level 5 system. We are building a system where the cognitive capability of the car is in control, but for the purpose of testing, until it is actually legal to offer that service, there will always be a driver in the car who can take over instantly.

Q163 Clive Efford: But there is an issue about when drivers take over from automated vehicles: they are over-cautious and slow down. There are concerns about whether that is dangerous at that moment in time and also it increases congestion because you suddenly have loads of slow-moving vehicles. You seem to be suggesting a flick of a switch and that it goes from driver to automated.

Stan Boland: While we are testing it. We are talking about a period when we are testing the capability of the vehicle in our existing cities. It is level 4—a highly automated or fully autonomous system—but for the period between now and a regulatory capability of doing this and, moreover, underwriting the risk of it, we have to have a driver in the car to take over.

Q164 Clive Efford: As the legislation is drafted, as long as somebody insures you, there is nothing stopping you putting that vehicle on the road for an experimental period in 2019.

Stan Boland: As long as there is a safety driver who can take over the car. That is not the same as somebody watching a Harry Potter movie while the car is self-driving. We are talking about a qualified driver who is paying full attention to the road scene all the time and can take over.

Clive Efford: To test—

Stan Boland: To test the vehicle.

Q165 Sir Oliver Letwin: To follow on from the hon. Member for Eltham, you are talking about level 4 rather than 3. Do you envisage that the machine's design will be able to engage in autonomous conduct on every kind of road from the very first moment that they are launched?

Stan Boland: No, that would be a definition of level 5 in our parlance: something that could literally drive anywhere on the planet and be able to work out what every object was, what the semantics of every scene was, and the human behaviour in that part of the world, so we are definitely not saying that.

Q166 Sir Oliver Letwin: So a level 4 vehicle has some of the aspects of a level 3 vehicle, in the sense that there will be certain road conditions and certain kinds of roads where it needs to hand back to the human driver.

Stan Boland: No, I think it would stop in that case. In the behavioural model, we were able to bring up a system that works in a defined geography and in defined driving conditions, but if one day the place is completely wiped out with snow, we probably would not drive on that day. Our business model is to deliver a service. It is a service model.

Q167 Sir Oliver Letwin: So I am driving along a motorway where your system is happy. I diverge on to a trunk road where your system is happy. I move from the trunk road on to a B road where your system is happy. It is a somewhat rainy or snowy day. I get on to a one-track road in my constituency and your machine suddenly decides it is not going to get me to my home.

Stan Boland: No, that is not the model at all. First, you would not buy one of these cars. This is a shared form of mobility that is offered in cities. You would not buy it because the sensors and the compute you have to put in that car make that prohibitively expensive. It adds some £30,000 to the car.

Q168 Sir Oliver Letwin: So these are city-only cars.

Stan Boland: City-only vehicles.

Q169 Sir Oliver Letwin: And they are available to drivers not as a vehicle, so to speak, but as a service on certain days of the year under certain conditions.

Stan Boland: Probably all days of the year, but there may be times when humans probably should not be driving, frankly. In those conditions our vehicles would not stop just like that, because that would be unsafe, but they would be able to be carefully brought to a slowdown to stop safely.

Q170 Sir Oliver Letwin: It is basically like not being able to get a cab.

Stan Boland: If you like, yes. We think there will in any case be remote supervision so that it would be possible for a control centre to be able to monitor any cars that are stopped and then perhaps carefully move them to some other place. We are expecting a remote control room with perhaps one per 30 cars or something that would be able to take over and carefully manage the car. We are also expecting the cars to have a limp-home system, so if there is a catastrophic failure there would be a limited amount of capability where the vehicles could—at quite a low speed and with warnings—find their way back to a service centre.

Q171 Mr Hayes: I have three questions. First, you made an interesting case in response to questions from my right hon. Friend the Member for West Dorset and the hon. Member for Eltham about what you see as the likely development in autonomous vehicles. I will put two scenarios to you, and I would ask you to describe the most likely one. There is an instinctive, intuitive view that autonomy will grow gradually, partly because that is more likely to lead to public acceptance. So rather in the way that assisted parking or sat nav or cruise control have become increasingly routine, other aspects of autonomy will be added to that. Autonomous vehicles will sort of creep on us.

There is another view that we may go straight to a kind of autonomous vehicle. Indeed I have looked at some of the R and D on that. As you may know, there is an entirely autonomous vehicle at Greenwich supported by Greenwich council, with some Government funding too. That is a vehicle that travels on a straight run of road that is entirely autonomous. You get into it, and it does what it says on the tin. Which of the two scenarios is the most likely, in your view? Or are they most likely to develop in parallel?

Stan Boland: They are developing in parallel today, so I think that is the state of affairs. The first of those can be characterised as the view of the German car industry, which is that these things will happen, but in 2035 or 2040. In the meantime we can just keep adding these features, keep selling people more features, and keep selling cars that people buy. However, I think the world was really shaken up by the challenges we saw in the 2000s and the emergency of Google cars and so on, as well as the idea that it was within touching distance for science to deliver fully autonomous capability in a relatively meaningful timeframe.

That really is the difference between level 2 and level 3 autonomy and what is really a huge jump to level 4 and level 5. Our entire business is predicated on level 4 and level 5 being the dominant model. We think that that is the dominant model for getting to a situation of safety in an urban environment. Significant amounts of algorithms, computer models, training data and sensors are involved in achieving this, which will considerably increase the cost of the car. We estimate that getting the car to human levels of safety will add a further £30,000 to £40,000 to its cost. That is not a car that people buy. That is definitely a service, and if it is a service then it is fully autonomous.

Q172 Mr Hayes: My second question is about software. We debated this to some degree today. Presumably, the challenge is to develop sufficiently sophisticated software to anticipate scenarios encompassing all kinds of different eventualities. An interesting question was put earlier by the hon. Member for Eltham about the element of human judgment in driving when faced with a dilemma, where you would hit traffic rather than a child, or you might swerve and possibly cause a more serious accident. The way that scenario planning is written into software would require hundreds of thousands of scenarios being tested. I know there is R and D being undertaken in this area. Would you briefly describe that to us?

Stan Boland: It is impossible to test all of that in the real world, and it would not be safe to do so. It has to be done as a simulation, which is the key to getting to the point where we have safe systems that can operate in our cities. We have to be able to simulate all the sensors on the car and all the different failure modes and so on. We have to simulate all the cases where our predicted models break down, or where somebody in the distance who is wearing a green pullover against a green wall with a reflective window near it cannot, for whatever reason, be seen in our systems. We have to be able to simulate those kinds of things—perception failures. We also have to simulate the extent to which we may not be

able to predict human behaviours. We may never have seen a particular behavioural type before, and it may be dissimilar to anything we have seen before.

We have to do all that in simulations, so the money is invested in creating a simulated world that may be like the whole of London, photo-accurate for example, and it may be that we create generative models that allow us to create every angle of a road—instead of 43 degrees, it is 44, 45 or 46. Instead of five objects, there are six; instead of a certain kind of road markings, they are slightly different. We can basically generate all that in simulations, so we can drive potentially billions of miles in simulation ahead of that software actually going in a vehicle and being sent out on the road. That is the way we can really assure the safety of those vehicles—a heavy investment in simulation. It turns out that the UK is good at that. The UK is good at artificial intelligence, gaming and simulation, so we are in a good position to do that.

Q173 Mr Hayes: So you are not simulating what is, as I put it, a tens of thousands scenario; it is millions. It is the whole of London, in all weather conditions, in all circumstances, for all vehicles, in all eventualities.

Stan Boland: Exactly. We will find real cases in the real world which we will codify. We are working with TRL to do that, to deliver a curated set of regression test cases.

Q174 Mr Hayes: Thank you for that; that was fascinating. My final question is about skills. We debated skills earlier; Mr Turner raised the issue and I then amplified it. From what you are describing, and I discovered this in my early research, the car mechanic of the future will be a software engineer as much as he is a mechanic, and that is going to require a step change in skills. Are we ready for that, and if not, what are we going to do about it?

The Chair: We will have to have Ministers with proper skills in future too. Sorry, Mr Boland, please answer the question—that was just a facetious remark. This must be the last answer, because we might have multiple Divisions.

Stan Boland: We definitely need more software engineers as a nation anyway, so we are probably not ready for any of this in terms of the total number of skills that we need to go alongside companies the size of Silicon Valley companies, but I think there is a kind of rarity about what—[*Interruption.*]

The Chair: Order. Thank you. I apologise, but we have been interrupted.

Ordered, That further consideration be now adjourned.—(*Andrew Stephenson.*)

4.33 pm

Adjourned till Thursday 2 November at half-past Eleven o'clock.

Written evidence reported to the House

AEVB 01 Anthony Beken

AEVB 02 Simon Canfer

AEVB 03 S Richards

AEVB 04 Professor James Davey

AEVB 05 International Transport Workers' Federation
(ITF)

AEVB 06 RAC

