

## Environment Committee – 6 November 2014 Transcript of Item 5: Diesel emissions in London

**Stephen Knight AM (Chair):** We are looking at the issues of diesel emissions in London and the issues that they generate in terms of air quality. This is the first of two meetings and in this meeting we are going to be looking at general issues of health and so on around diesel emissions and in particular we are going to be looking at diesel emissions from buses, goods vehicles and cars. We are having another session in December when we are going to look specifically around taxis and minicabs as a separate area. At that meeting, hopefully, we will have representatives from Transport for London (TfL). Sadly, they were not able to join us at today's meeting.

However, we do have before us eminent guests, two professors from King's College London (KCL). Professor Martin Williams is a Professor of Air Quality Research and I believe you are expert in particular at the relationship between air quality and health and the effectiveness of air quality policies on urban and regional air quality as evidenced by measurement. We also have Professor Frank Kelly, a Professor of Environmental Health at KCL and I believe your particular specialisms are around the issue of mechanisms of air pollution-induced lung injuries; that will be very interesting to us. We hope to be joined shortly by Mike Hawes and Ian Bacon from the Society of Motor Manufacturers and Traders (SMMT), who will be able to give evidence as well.

I will kick off the session, then, by asking our two guests to give us their view on what the role of diesel emissions in contributing to London's wider air pollution problems is and what the contribution that comes from diesel in particular is.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Let me first give you the big picture of road transport in total contribution to concentrations in London. I am talking initially here about contribution to concentrations as opposed to emissions because, as you will appreciate, there is a difference. You can have a lot of emission that is emitted at quite a high level and makes a very small contribution to what we breathe on the ground. I am talking about concentrations initially.

Road transport, averaged across London, contributes something of the order of 42% to NO<sub>x</sub> concentrations - NO<sub>x</sub> as in nitrogen oxides - and around about 13% to concentrations of particulate matter less than 10 microns in diameter (PM10) and around about 8% to concentrations of particulate matter less than 2.5 microns in diameter (PM2.5). These were figures in 2010. They change a little bit on our projections to 2020 in a kind of business-as-usual scenario where the road transport contribution goes down for NO<sub>x</sub> from 42% to around 30%. PM10 stays roughly the same at around about 12% and PM2.5 goes down from 8% to around 7%. Those figures are averaged across the whole of the Greater London Authority (GLA) area.

I obviously could not run through every busy road, but what I have done is pick out some numbers that are relevant to Marylebone Road, for example. There, of course, the road traffic contribution is much larger. The contribution to NO<sub>x</sub> contributions at Marylebone Road in 2010 was around 83%, to PM10 around 49% and to PM2.5, 38%. Projecting to 2020, they change a little bit but not a great deal on business-as-usual. In 2020, the road traffic contribution to NO<sub>x</sub> at the roadside there is 78%, around 47% to PM10 and 32% to PM2.5.

I could break that down more. Let me give you estimates, then, of the diesel contribution across the GLA area in 2010. Of that gross figure of 42%, the split was roughly a quarter from diesel cars, around 11% from diesel - like goods - vehicles, London buses around 17% and heavy goods vehicles around 25% in 2010. The diesel

car contribution goes up, in fact. While overall concentrations have reduced a little bit, the contribution from diesel cars, for example, goes up to around 45% in 2020.

**Stephen Knight AM (Chair):** Is that because there are more diesel cars as a proportion of the vehicles on the road?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** It is because the emissions of NO<sub>x</sub> from diesel cars do not go down as much as from petrol cars. There are still some relatively old petrol cars driving around, which have higher NO<sub>x</sub> emissions than new petrol cars, still much lower than diesel cars. The reason the proportion of the diesel car contribution goes up is because the emissions do not come down as much as for petrol cars.

**Stephen Knight AM (Chair):** Whilst petrol car emissions have been falling, diesel car emissions have stayed relatively high in comparison?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** They have up until Euro 5<sup>1</sup>. For Euro 6 diesels, the indications are that they will show an improvement over Euro 5 diesel cars and the figure is around 40%, maybe more.

**Stephen Knight AM (Chair):** We will come to a more detailed discussion around the Euro standards and the performance of those a little later on. You have mentioned PM10 and NO<sub>x</sub> but are they the main two pollutants that are associated with diesel exhaust emissions? I wonder if you could say a little bit about the difference between NO<sub>x</sub> and nitrogen dioxide - which is obviously an element of NO<sub>x</sub> - and the relative proportions and problems associated with that.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** PM2.5/PM10 are one area and NO<sub>x</sub> and nitrogen dioxide, which is the particular pollutant of interest here. Those are the two categories of pollutants that are really of importance in regard to diesel emissions. We can come on to the reasons for that and the health evidence in a little while, maybe.

You are right to mention nitrogen dioxide. The health evidence is increasing for nitrogen dioxide and, again, we will come back to that perhaps, but obviously, as you will be aware, we have a big legal compliance problem for nitrogen dioxide. There, the proportion of nitrogen dioxide in emissions from diesel and from other sources is crucially important. We have measurements at KCL which suggest that the fraction of nitrogen dioxide in the NO<sub>x</sub> emission can vary quite widely. You can have very similar total NO<sub>x</sub> emissions but wildly different nitrogen dioxide emissions. That is crucially important when one is looking at the near-field concentrations of nitrogen dioxide near the kerb or near the roadside in terms of a legal compliance problem.

**Stephen Knight AM (Chair):** I have heard that some more recent diesels have actually had a higher concentration of nitrogen dioxide in their exhausts than older diesels because of issues with reducing particulate matter. It is helpful to have more nitrogen dioxide in the exhaust in terms of burning off the particulates. Is there a trade-off that is happening there in more modern diesels which is actually leading to higher concentrations of nitrogen dioxide?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** That has happened over the past series of Euro standards where oxidation techniques, oxidation catalysts and particle removal traps were employed to initially remove carbon monoxide and hydrocarbons and latterly to burn off the particles and a

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<sup>1</sup> The "Euro X" terms used throughout this transcript refer to European emission standards, for more for information see [ec.europa.eu/environment/air/transport/road.htm](https://ec.europa.eu/environment/air/transport/road.htm)

kind of oxidising environment was created in the exhaust to deal with those pollutants. The downside of that was that nitrogen dioxide emissions as a fraction of the total NO<sub>x</sub> went up.

The latest technology and the latest standards of Euro 6 and Euro VI for heavy goods vehicles will require NO<sub>x</sub> after-treatment, selective catalytic reduction, lean NO<sub>x</sub> traps or whatever, which should in principle clean up that nitrogen dioxide problem. However, some measurements that we have suggest that there still can be quite wildly varying nitrogen dioxide fractions in the NO<sub>x</sub> emission.

**Stephen Knight AM (Chair):** We will perhaps come back to you on that a bit later on. Is there anything you want to say on what type of diesel engine generates more or less of these various pollutants than other forms? With the exception of Euro 6 potentially, has there been little improvement?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Up until Euro 6, there seems to be very little improvement in total NO<sub>x</sub> emissions from real-world diesel cars and to some extent trucks and buses. There has been an increase on average, I guess, of the nitrogen dioxide to NO<sub>x</sub> fraction over that time.

I could not give you any indication of whether different technologies or which different technologies or whatever that show variability in that. Perhaps our colleagues from the SMMT can. The evidence that we have acquired so far from our remote sensing measurements at KCL suggest that across a range of manufacturers, the combination of the vehicle plus the different types of after-treatment can show quite wildly varying fractions of nitrogen dioxide to NO<sub>x</sub>. I could not give you the reasons for that. I am not sufficiently knowledgeable about the engineering issues that give rise to that.

**Murad Qureshi AM (Deputy Chair):** I just wanted to come back to the trade-off between carbon emissions and diesel. In some ways, part of the reason we are here is that diesel sales were encouraged at the beginning of the century. Around 2000 they were about 14% of car sales. Now they are about half of car sales. It was encouraged to reduce carbon emissions globally. To what extent can we say that that has actually exacerbated - or not helped - the local pollution problem that we have?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** It has. It is fairly clear that that increase in diesel use has contributed to the lack of improvement in ambient NO<sub>x</sub> and nitrogen dioxide concentrations. That is fairly clear. We can go into the reasons why that happened if --

**Murad Qureshi AM (Deputy Chair):** Was it not clear that would happen at the time?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** No, I do not think it was. Those decisions to incentivise diesel were taken for three reasons. By and large, they were taken in good faith, I think.

Firstly, climate was a big issue and high-profile. Big importance was accorded to climate issues and the carbon dioxide (CO<sub>2</sub>) problem was prime. Secondly, the science was not there to understand the total impact of diesel emissions on the climate. There was very little agreement and consensus on global warming and the potential of black carbon, for example - the soot from diesel. Now in the last few years there is general agreement across world scientists that black carbon has a global warming potential of 900 compared with CO<sub>2</sub> of 1. Thirdly, we thought the Euro standards would work and would clean up the air pollution emissions.

With hindsight they have not, but at the time those decisions were probably taken in good faith. We now realise the problem. Fortunately, we are in a position to do something about it.

**Murad Qureshi AM (Deputy Chair):** Frank, do you concur with that as well?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Absolutely, yes.

**Murad Qureshi AM (Deputy Chair):** Are we better in our understanding of the trade-offs between the two? Can we have both at some point or do we have one at the expense of the other?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Yes. You would have to think more widely in terms of vehicle technologies and fuels and ultimately, of course, the electric vehicle is the answer. In the meantime, there are technologies and choices out there which can give you improved CO<sub>2</sub> and improved air quality. Hybrids, for example, are the interim solution before we get fully electric.

**Murad Qureshi AM (Deputy Chair):** It just strikes me that it is not dissimilar to when we have dealt with environmental aviation issues. Locally, it is the aircraft noise which is the big issue rather than the CO<sub>2</sub> emissions, although we may get a different perspective from different groups.

**Jenny Jones AM:** You were Head of Air Quality, were you not, at the Department for Environment, Food and Rural Affairs (Defra)?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Yes.

**Jenny Jones AM:** When was that decision taken? Do you have the year? I am just curious about this because decisions are taken all the time about quite big issues and I am curious about this.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** From memory, it was around 2000 or thereabouts, give or take a few years.

**Jenny Jones AM:** It is so recent. At what level does a decision like that get signed off? Does it have to go up to the Minister?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** It is Government policy, agreed at Cabinet level.

**Jenny Jones AM:** There was no awareness at the time of the damage that diesel emissions can do?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** No. As I say, the thinking at the time was that climate was an extremely important issue. We felt that the Euro standards would work. If you look at the regulations, there was a really big tightening over that period and you can look at the published air quality reports of the time. We were projecting big drops in air pollution emissions. We thought they would work.

**Nicky Gavron AM:** I just wanted to come in on the fact that in the 1990s I was at one stage Chair of Technical and Environmental Services for the London Borough of Haringey. We put air quality monitoring above buildings and then low down by the exhaust pipes in the three main roads, Tottenham High Road, Wood Green High Road and Archway Road, not because of carbon but because of the impact on health. We were trying to demonstrate that. There was air quality monitoring on health grounds but it was not distinguished between diesel and petrol.

I just want some clarification because we have been monitoring for a couple of decades now, two-and-a-half or more. Just go back on the history because we have known of the impact on health for a long time. It just was not conclusively proven, was it? It was also not pinned down particularly on diesel.

**Professor Frank Kelly (Professor of Environmental Health, KCL):** That is correct. The largest evidence base that we have to link poor air quality and health outcomes is in relation to particles. Clearly, both gasoline cars/petrol cars and diesel vehicles produce particles. The epidemiological studies which produced the evidence linking the emissions with the health effects were based on the mass of particles that were released and it did not matter what their origin was.

**Nicky Gavron AM:** We only talked about PM10 in those days. We did not talk about PM2.5.

**Professor Frank Kelly (Professor of Environmental Health, KCL):** In those days in this country that is true because we did not monitor PM2.5 but information that came from the USA provided a very solid base to say that in fact, yes, all particles are dangerous but we think the smaller ones are more dangerous. That subsequently led to the legislation in Europe to put a limit value in. However, there was no differentiation of the source of the particles.

It was only subsequently in the mid-2000s, probably, when we had more information around diesel emissions - which were being measured as 'black carbon' and which Martin [Williams] has already mentioned - as opposed to PM2.5 that we started to see that in fact black carbon exposure gave a much bigger health impact than PM2.5 mass *per se*. That was along with the realisation that diesel vehicles were producing many more particles in greater concentrations than petrol vehicles. If you add those two things together, then the focus started to come more closely on diesel emissions.

**Nicky Gavron AM:** When was that known?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** It takes many years of accumulation of evidence before statements can be made by the appropriate bodies. It was in 2012 that the World Health Organisation (WHO) produced a report which stated that exposure to one unit or one gram of black carbon would relate to a loss of life expectancy between four and nine times that of exposure to an equivalent amount of PM2.5.

**Stephen Knight AM (Chair):** Black carbon is smaller again than PM2.5?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Black carbon is part of PM2.5 but it is a different type of particle and it is measured in a different way. PM2.5 is measured by mass.

**Stephen Knight AM (Chair):** OK. It is one of the components of PM2.5?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** It is one of the components and, if we are talking about diesel emissions, it makes up a large component of PM2.5 from diesel vehicles.

**Stephen Knight AM (Chair):** PM2.5 from diesel is significantly more damaging than PM2.5 from other sources, you are telling us?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** That is what that statement is indicating.

**Jenny Jones AM:** Does it vary in different diesels?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Yes. Diesel technology has evolved tremendously. A lot of the work is looking at the early technology diesel engines in the early 2000s. They

have evolved a lot from that. We now have different diesel fuels going right up to biodiesels. It is a very complex area. However, in general for diesel emissions, the particles tend to be smaller, they go deeper into your body, they tend to be more complex and their toxicology as a consequence seems to be --

**Nicky Gavron AM:** You have just talked about black carbon. Could you just take us through the health impacts of these different emissions you have mentioned? We need to know a little bit more about the distinction between NO<sub>x</sub> and nitrogen dioxide as well.

**Professor Frank Kelly (Professor of Environmental Health, KCL):** On the health impacts, where we are on solid ground is with the exposure to particles. In this particular inquiry, it is looking at diesel particles and that is black carbon and we have been through that evidence base. The health outcomes are they all cause mortality, respiratory conditions such as chronic obstructive pulmonary disease (COPD).

**Nicky Gavron AM:** They cause it?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** They are associated with the development of that disease, yes.

**Nicky Gavron AM:** Can I be very clear? I am just going back over history, but what we all thought was that they exacerbated asthma, these pollutants --

**Professor Frank Kelly (Professor of Environmental Health, KCL):** That is what I was just about to say --

**Nicky Gavron AM:** They exacerbated asthma and exacerbated respiratory diseases but did not cause them. What seems to be new is the causal link. Can you go over that, as well as going over the different emissions?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Yes. All of them cause mortality, COPD, cardiovascular disease and low birth-weight outcomes in pregnancy. There is weaker but accumulating evidence for a whole range of other conditions. For asthma, there is still no strong evidence to say that exposure to air pollution causes asthma, but it is a trigger for asthma.

**Nicky Gavron AM:** I want to ask you about research in a moment, but can you just go back and explain about the NO<sub>x</sub> and the nitrogen dioxide versus the particulates and the black carbon? Is it just a terrible cocktail or are some bits of it worse than others?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** It is a terrible cocktail and we really only know about the individual components. That is one of the challenges we have. You have heard oxides of nitrogen are produced in larger quantities by diesel vehicles. Some of those oxides of nitrogen are nitrogen dioxide itself. Some of the NO<sub>x</sub> is converted to nitrogen dioxide in the atmosphere away from roads. The entity which we think now is having a health effect is nitrogen dioxide itself. It is not NO<sub>x</sub> *per se*. However, because nitrogen dioxide concentrations have not really fallen in urban areas for the last decade and because our understanding of the health effects of nitrogen dioxide - separately from our understanding of the health effects of small particles - has accumulated a lot, we are now worried about both of those pollutants. Very soon, a number of learned bodies will produce statements on the health effects of nitrogen dioxide, which in reality are similar to what we have been hearing about particles for the last ten years, but the impact is greater because the concentration of nitrogen dioxide in urban areas is so great.

**Nicky Gavron AM:** Can I just take us back? In 2007 after we had done all the exemptions on the Congestion Charge and so on and were totally unaware of diesel versus petrol, we discovered in all the newspapers that the University of Southern California (USC) had come out with this rather dynamite research. You will know it

much better than me. It was graded by how far away your residential road was from a gridlocked road. If you lived on a very polluting road or nearby, your lungs as a child would not develop to their full capacity. They would not be as large as they would have been if you had not lived close to or on that road. They graded it and they did a longitudinal study up to 18. They established some causal links as opposed to just anecdotal links with certain respiratory diseases and I am not sure what they did on asthma.

That research has been redone here, has it not? Can you tell us about this? At the time, we were all absolutely shocked rigid. How do you respond to that? There is no one silver bullet, of course. You have to do it with many measures. Can you just tell us about that research and how it has been redone here?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** That probably is the most worrying finding associated with poor air quality. As you refer, it is the USC Children's Health Study. When those findings were reported, it was acknowledged around the world that if this was really true then this was something which we needed to get to grips with for our current generation and future ones.

A number of studies were started up asking the same question in different areas of the world. One of them was started here in London. Initially, it was even supported with funding from TfL as part of the Low Emission Zone (LEZ). That study, which is called Exploration of Health and Lungs in the Environment (EXHALE), was based in Tower Hamlets and Hackney in east London because there are high levels of exposure to diesel vehicles from the roads there and we thought the LEZ would help minimise that. The study has just finished in respect of data collection earlier this year. The first three years of the findings – 2009 to 2011 – have been unblinded and from that initial analysis there is an indication that in London we are seeing similar sorts of signals in respect of exposure and restricted lung growth in children. That data is not published. It is submitted for publication at the moment and will need to go through peer review.

However, the other thing you should realise is that London is not the only place that has started work like this. There is work being done in Stockholm, where the pollution levels are much lower than they are in London, and there has been work done in Asia – in both China and in Japan – which has come up with the same sorts of findings.

The general view is that there is something about being exposed to the sorts of ambient levels of air pollution we have in many of our urban areas at the moment at an important time in development as your lungs are growing and that is having a negative influence.

**Jenny Jones AM:** My question was whether it is time for a new Clean Air Act. Is it time to actually ban diesel exhaust from the most polluted areas?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** If I could jump in, we are focusing on diesel, clearly, and it is, as you heard from Martin [Williams], a major source of the problem that we have in urban areas. It is not the only source of problem, though. We need to look at all options for reducing both the release of these particles and gases into our urban areas and also the exposure of the population to those.

The wonderful thing about the Clean Air Act 1956 was that it took the source of the problem out of the city and away from the people. Just banning diesels is probably not going to be sufficient for a 2015 Clean Air Act to achieve what we need. We really need to probably go beyond just looking at one source of emissions in our city.

**Jenny Jones AM:** Forget a new Clean Air Act, but is it time to ban diesel exhaust in the most polluted areas and in our urban areas?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** It depends what you mean by 'diesel'. There is a whole range of diesel vehicles and diesel sources out there, not least from so-called non-road mobile machinery, which is a significant source, too.

It is an issue that we as scientists would not venture into. We have heard the evidence. There is no question that diesels make a big contribution to poor air quality. They affect human health. There are solutions. There are cleaner choices to be made. How you achieve that clean-up is an issue for policymakers because there are other issues around this beyond pure science. There is the whole socioeconomic issue to think about. There is no question that if you banned diesels, you would have much cleaner air quality and fewer impacts on public health. That is undeniable. Whether you do that and take such a draconian step is a matter for --

**Jenny Jones AM:** Give us advice.

**Stephen Knight AM (Chair):** Perhaps we are asking you to delve into an area of policy decisions, which is perhaps not where you are comfortable.

I wonder if I could bring us back to the health impacts because I know that there have been various estimates published on the number of premature deaths per annum caused by particulate pollution. We have seen figures varying from 3,000 to 4,500 a year in London - or something around that quantity - of premature deaths per annum. All of those estimates were really looking at particulate pollution in particular. Have there been similar estimates done for the global health impacts from nitrogen dioxide?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** No, they have not as yet because we were not in a position to come up with the appropriate risk coefficient for exposure to nitrogen dioxide. The evidence base was not strong enough. It now has become strong enough and there will be equivalent work done for nitrogen dioxide in the very near future.

**Nicky Gavron AM:** I wonder if I can just press you on what you mean by 'the very near future'. Are we thinking later this year?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** I was in a meeting of the Committee on the Medical Effects of Air Pollutants on Monday and this subject was discussed. We hope to be able to make a statement on nitrogen dioxide by the end of this year and we hope to provide guidance as to how those calculations should be done. I would imagine that that will be done in the first part of 2015.

**Stephen Knight AM (Chair):** Obviously you are not able to tell us what those announcements are likely to say, but are we talking a very similar sort of impact to particulates or smaller or bigger? Are you able to say, for instance?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** The risks associated with nitrogen dioxide seem to be as large as they are with PM2.5 and, given that we are, in our urban areas, experiencing very high concentrations of nitrogen dioxide, the mathematics would indicate that in fact the number would be larger.

**Stephen Knight AM (Chair):** The number will be larger and can we --

**Nicky Gavron AM:** Wait a minute. The number will be a proportion of the deaths we already know. Will you not be able to be more precise in what you are saying on the causes?



**Professor Frank Kelly (Professor of Environmental Health, KCL):** At the moment, the risk that Stephen [Knight] talked about is only in relation to PM2.5 exposure across the UK or in London. When you then consider the other pollutants, they would be additive to that number.

**Stephen Knight AM (Chair):** That will mean that the number of deaths from air pollution, taking the two together, will be significantly higher than the figures we have had up until now?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Yes. There is one note of caution. They both come from the same source and there will be some confusion as to how much overlap there is between the two. That, again, is an area which is under discussion at the moment. It will not be two totally separate numbers. There will be some compensation for that overlap.

**Stephen Knight AM (Chair):** We could be looking at five figures, almost, in terms of total impact?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** I am not in a position to go beyond what I have just said.

**Nicky Gavron AM:** Can we just go back to the children? You have done longitudinal studies now on children in London or you are doing them?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Yes.

**Nicky Gavron AM:** Are you mirroring USC's results in terms of children's lungs being smaller if they have a lot of exposure to these pollutants?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** The early findings suggest that that is the case, yes. However, as I said, it needs to go through full peer review before that --

**Nicky Gavron AM:** When will you have finished that?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** The papers are being submitted for publication now. If it goes through quickly, it will be a few months. If there are discussions to be had with the reviewers, it will take longer than that.

**Nicky Gavron AM:** Are other countries ahead of us in mirroring this research?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Some countries have already published similar research, but I would not necessarily say they are ahead of us because there are very few countries that have actually then taken action to remedy and to try to decrease exposure for children.

**Nicky Gavron AM:** Which other countries?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Sweden, Japan and China.

**Nicky Gavron AM:** I am just thinking because Europe is so wedded to the diesel and I was just interested to know how many other European countries are actually looking at this.

**Professor Frank Kelly (Professor of Environmental Health, KCL):** I am not aware of any substantial studies which are examining the same question. Many other European countries are looking at effects in pregnancy and pregnancy outcomes, as opposed to early childhood development. Different countries are doing different things for different reasons.

**Nicky Gavron AM:** It has been known for a long time that it affects birth weight and low birth weight is a huge health indicator, is it not?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Yes. It tracks through life.

**Nicky Gavron AM:** It is this link with smaller lungs and respiratory diseases in children that is so concerning. On PM10 and what we know there - because we know that for sure and all the peer review has been done, etc - would you say that policy has lagged way behind scientific evidence?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** For particulate exposure in Europe, I would agree with that, yes, because the evidence base was examined by the WHO in 2005 and it recommended a limit value of, for example, for PM2.5 of 10  $\mu\text{g}/\text{m}^3$ . The eventual limit value which was agreed by the commission was 25  $\mu\text{g}/\text{m}^3$ . That is considerably higher, as you can imagine, than 10 [ $\mu\text{g}/\text{m}^3$ ]. This is why you often hear that large cities in London do not have a particle problem because they are under 25  $\mu\text{g}/\text{m}^3$ . London is at roughly 15  $\mu\text{g}/\text{m}^3$  but 15  $\mu\text{g}/\text{m}^3$  is 50% above what the WHO thinks it should be at.

**Stephen Knight AM (Chair):** At this stage I welcome our two guests from the SMMT. Welcome to this session and thank you very much for joining us.

I wonder if there is anything you would like to say at this stage, before we go on to a detailed discussion around different vehicles, around diesel exhaust and emissions. Is there anything you would like to add?

**Mike Hawes (Chief Executive, SMMT):** Thank you for the opportunity. We would probably first say that the issue is very much at the top of the agenda of the motor industry. It is an issue which we as an industry are looking at and dealing with, to a large extent, but it is not the only issue we are dealing with. You have rehearsed some of the issues we face in your previous questioning around the effects on climate change from carbon emissions and also issues around maintaining safety of vehicles and the balance between the various issues that the industry has to manage. It is fundamental to how we design and develop cars and also to how the regulation evolves, which is obviously the standards that we have to meet.

I would suggest that we certainly have made great progress in addressing some of those issues. They are not by any means addressed, but some of the latest technologies - some of which have been mandated from the beginning of this year on certain vehicles and certainly on some passenger cars are now available and mandated on new models from September and on all models from next year - will go a long way to addressing some of the issues that you have heard. I do not think it will be the complete solution, but again it is the developments that we constantly make and investments we make as we respond to emerging science and as regulation, obviously, and policy changes according to that emerging science.

**Stephen Knight AM (Chair):** We heard earlier that of course in policy terms the focus has been on carbon reduction for the last decade.

**Mike Hawes (Chief Executive, SMMT):** It has.

**Stephen Knight AM (Chair):** Indeed, many of your members have been producing eco-vehicles and green versions of their vehicles which are entirely diesel because they have higher levels of carbon reduction. Indeed, all the adverts for low-emission vehicles are concentrated on CO<sub>2</sub> emissions. I suppose your members have simply followed the lead set by policymakers in this area, but certainly with the drive to diesel in the UK - and perhaps on the continent there has already historically been more diesel uptake anyway - motor manufacturers seem to have embraced the drive to diesel over the last decade. Would you say that is fair?

**Mike Hawes (Chief Executive, SMMT):** That is fair. Diesel on the continent or in the rest of Europe has been a higher proportion of new car or new vehicle sales and indeed obviously the car-park as we know it thereafter. Over the last 10 or 15 years or so, we have seen a significant increase in the proportion of new car sales that are diesel. Ten or 15 years ago, it was around 20% or 25%. It is now around half. We have just released the figures for new car registrations this morning for October and, again, it is similar. It is just under 50%. The most significant growth is in alternatively fuelled vehicles and that is a trend we are seeing not just in the UK but across the rest of Europe and indeed the world, although it is starting from a very low base.

There are a number of reasons why diesel sales have increased in the UK. Diesel engine technology in terms of performance has become a lot better. They are undoubtedly a lot cleaner than they were. With the adoption and development of the common rail diesel engine, they do not rattle as much as a diesel of 20 years ago. Without doubt, they deliver improved fuel economy, something like around 20% compared to a gasoline engine. That obviously affects the number of times you have to fuel your car and with the fiscal arrangements around motoring taxation, given that they are predicated on fuel economy and CO<sub>2</sub> emissions, obviously there is a benefit to the consumer. Put those issues together and that is really why consumers have been voting for diesel engines.

**Stephen Knight AM (Chair):** Are we seeing the industry recognise that with the current policy focus around air quality, as opposed necessarily to the previous domination of carbon reduction, the age of diesel may well be coming to an end? Is there increased investment in alternatives to diesel?

**Mike Hawes (Chief Executive, SMMT):** Investments in more fuel-efficient technologies by the motor industry have not just focused on diesel engines. Diesel engines do offer that benefit, as I said, but you will see across every single manufacturer a range of different technologies coming to market, whether they are hybrids, gasoline hybrids, diesel-electric hybrids, plug-in hybrids or pure electric battery vehicles. We have seen most recently the announcement of someone bringing some hydrogen vehicles to market.

**Stephen Knight AM (Chair):** I guess my point is whether manufacturers are planning their future manufacturing around a reduction in the amount of diesel or whether they are still planning for diesel cars to be on sale in several years' time. Are they recognising that the tide is flowing against diesel?

**Mike Hawes (Chief Executive, SMMT):** The internal combustion engine, whether it is gasoline or diesel, will still be around for many years yet to come. We have invested in cleaner technology. We have had to do that with the various standards that have been introduced and continue to be implemented, Euro 6 being the latest, the first part of which takes effect from this year. It is not that we have just focused solely on fuel economy. We have also driven down emissions in terms of particulates and NO<sub>x</sub> significantly, as well as addressing the other challenges we face when developing cars.

**Jenny Jones AM:** Just on the figures you mentioned, you said new car sales. Was that UK-wide or do you have a figure for London of the percentage of diesel vehicles sold?

**Mike Hawes (Chief Executive, SMMT):** I do not. I can provide that subsequently.

**Jenny Jones AM:** I am curious whether it has fallen because of the --

**Mike Hawes (Chief Executive, SMMT):** What you will find is that the sales of alternatively fuelled vehicles will be higher in London than in the rest of the UK because you have a Congestion Charge, which provides, again, another significant fiscal lever to encourage people into those sorts of vehicles.

**Jenny Jones AM:** It would be interesting for us to see the London figures to see what differences there are.

**Mike Hawes (Chief Executive, SMMT):** I will see what we can provide. This would be new car registrations?

**Jenny Jones AM:** Yes.

**Stephen Knight AM (Chair):** This next area is around the Euro standards and how they apply particularly to private cars.

**James Cleverly AM:** Thank you, Chair. I am interested to explore the impact or lack of impact of the Euro standards. When pushed on this, Defra said,

*"In conclusion, the main reason why the UK has not been able to achieve full compliance with the nitrogen dioxide limit value is that despite the introduction of vehicles meeting increasingly stringent Euro standards, real world emissions of NO<sub>x</sub> from many vehicle classes have been considerably higher than anticipated."*

Is that fair?

**Mike Hawes (Chief Executive, SMMT):** Yes. That is fair. Again, what that is getting at is in terms of the test cycle, which measures new car performance and real-world emissions. There is a difference, as we acknowledge.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Yes, I would agree. That is a very fair point. The test cycle is a problem. Manufacturers have done what they were required to do by law. The law, in this case, just is a failure. The test cycle is far too benign to represent real-world driving. When you get a car that can pass the test on a chassis dynamometer in the laboratory and then you put it out on the road, the engine conditions are quite different and lead to higher NO<sub>x</sub>.

**James Cleverly AM:** OK. That is where we are up until this point. With Euro 6, are these issues, to your knowledge, going to be addressed? What is going to be the impact of Euro 6?

**Mike Hawes (Chief Executive, SMMT):** Yes, they are being addressed. The Euro 6 vehicle will capture around 99% of PM emissions and in terms of NO<sub>x</sub> emissions, again, something like two thirds.

The test cycle that Martin [Williams] refers to is being scrutinised and is being changed. We currently have something called the New European Driving Cycle (NEDC), which dates back 30 or 40 years. Discussions have taken place within Europe and wider forums before the introduction of the Worldwide Harmonised Light Vehicles Test Procedure (WLTP), which should be a global test cycle. That is likely to be implemented within probably about three years. That will have an element of real-world emission testing as part of it.

The discrepancy that you see between published test-cycle figures and real-world economies, which to be honest does the industry no favours, will narrow. There will always be a difference because it is a test and part of that test will be in a laboratory on a dynamometer and people do not drive in a uniform way, nor do they maintain vehicles in a uniform way or, indeed, load vehicles in a uniform way.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Can I just add to that? The Worldwide Harmonised Light Vehicles Test Procedure is an improvement on the NEDC, but within the European Commission it is still felt to be not aggressive enough to represent what is going on in the real world.

The European Commission is actually trying to formulate an additional test which will - in principle, anyway - or the aim is to actually replicate what is going on in the real world. Negotiations and discussions are still going on, but that additional test might actually be based on real-world drives with instrumented cars and so forth. The technology required to meet Euro 6, current indications suggest, will give an improvement in NO<sub>x</sub> over Euro 5, but this additional test should actually improve matters. We will learn from history and make sure that measurements are done to check on that, but the aim anyway is to try to clean up this problem completely. We will see if it works.

**James Cleverly AM:** Mike, you mentioned the capture of 90% plus or 99%, did you say?

**Mike Hawes (Chief Executive, SMMT):** Of particulates, yes.

**James Cleverly AM:** That is reliant on things like particulate filters, is it not?

**Mike Hawes (Chief Executive, SMMT):** Yes.

**James Cleverly AM:** What would be the impact of the removal of those filters on those results? What I am keen to find out is how much of it is the engine technology and that part of it and how much of it is the ancillary filtering process.

**Ian Bacon (Technical Manager, SMMT):** If the engine has been designed expecting a particulate filter, they will be significant if we removed the filter. The engine can do so much and the filter mops up the rest. Removing the filter would be a very serious problem.

**Mike Hawes (Chief Executive, SMMT):** If a car is taken into a dealership or something without a diesel particulate filter (DPF), the car will fail an MOT and should not be on the road.

**James Cleverly AM:** OK. That is useful.

**Stephen Knight AM (Chair):** It is a MOT requirement to have a filter?

**Mike Hawes (Chief Executive, SMMT):** If it has been removed, it will fail, yes, because obviously there are older vehicles that do not have DPFs, historic and so forth, which are still licensed to be on the road.

**Stephen Knight AM (Chair):** There have been reports of various garages offering to remove particulate filters to avoid the maintenance problems with them and so on. Are you aware of that and how do the drivers of those vehicles get around the MOT?

**Mike Hawes (Chief Executive, SMMT):** We are aware of it. We certainly would not endorse it. Again, if it has been physically removed, it would fail the MOT.

**Stephen Knight AM (Chair):** Is that a change to the MOT requirement that is fairly recent?

**Ian Bacon (Technical Manager, Society of Motor Manufacturers and Traders):** Yes, it was brought in at the beginning of this year.

**Jenny Jones AM:** This whole issue of lab tests versus real road conditions has been absolutely infuriating because of course all sorts of spurious claims are made on the basis of lab tests which are then not corroborated when the vehicles are actually out on the road. Hearing that there might be some road tests is very heartening, but I am just wondering how exhaustive those tests are going to be so that we can have

accurate figures. Accurate figures are absolutely crucial and, as you said, it does not do your business any favours, either.

**Mike Hawes (Chief Executive, SMMT):** Indeed. Those so-called 'claims' are not spurious. The way the testing works is that they are --

**Jenny Jones AM:** No, they are spurious because the lab tests are equated with what is going to happen under real-life conditions. I would say that it is spurious if you use a lab test for --

**Nicky Gavron AM:** Can you say the claims made by manufacturers are not corroborated when you do road tests?

**Mike Hawes (Chief Executive, SMMT):** Again, on the contrary, the vehicles are tested and are verified by independent third parties. In the UK, it is often the Vehicle Certification Agency (VCA). They are performed against this test, which, as we said, is flawed and has not been developed as technologies have developed. That is changing, as I said before, as is having a discrepancy between the test figures, which by law when we are advertising we have to specify. We have no choice, we have to say what those test figures are because they provide the comparison between all of the vehicles on the road. The development of the WLTP will be more stringent.

**Jenny Jones AM:** In urban conditions?

**Mike Hawes (Chief Executive, SMMT):** In urban and extra-urban combined.

**Jenny Jones AM:** It is the urban that we care about because of course it is quite different driving.

**Mike Hawes (Chief Executive, SMMT):** Yes. Obviously, we have to develop vehicles not just for urban and, again, it goes back to what consumers want and choose when buying a car. If we are talking about individual private retail, they often want a vehicle not just to be able to drive in an urban area but also to go on a motorway or go on holiday and have that utility.

**Jenny Jones AM:** I would like to ask a couple more questions about the removal of filters as well. It is good to hear they will fail the MoT, but do you have any idea of the size of the problem?

**Mike Hawes (Chief Executive, SMMT):** I think the answer is no.

**Jenny Jones AM:** Is it a question you ask? Is it a problem you are trying to assess the size of?

**Mike Hawes (Chief Executive, SMMT):** Yes, to a certain extent, obviously, but it is not a practice that we would in any way endorse. Clearly, any practice which undermines the performance of the vehicles that manufacturers produce and invest billions in developing to give that required emission performance we would not support and, clearly, we would be actively trying to dissuade individuals and indeed businesses from undertaking that sort of practice. Given the nature of it, it is close to a black market activity, really, I suppose.

**Jenny Jones AM:** For example, your members do deal with second-hand vehicles and at that point you can measure just how many vehicles have had their filters removed. What advice are you giving to your members at that stage? Are you asking them to report it?

**Mike Hawes (Chief Executive, SMMT):** We do not specifically ask them to. However, we represent motor manufacturers who have franchise dealer networks. In terms of new cars, they will be offering three, five and up to seven-year warranties now and generally will deal with used cars in three to five years. Once they are out

of that warranty period in three to five years, they tend to go into the independent network, which we do not represent. We do not have a strong handle on how prevalent it is in that market but it is unlikely, certainly in private retail, to be happening to the sort of vehicles that are three to five years old because it would be undermining the performance in other ways.

**Jenny Jones AM:** Does it actually improve the performance of the car in terms of speed and so on if you take the filter off?

**Mike Hawes (Chief Executive, SMMT):** It can improve acceleration.

**Jenny Jones AM:** Motorheads! Not you; I mean the people who take their filters out.

**Murad Qureshi AM (Deputy Chair):** Would it help if there was criminal action taken and looked into, given that you do not know too much about it? There has been a message given at the beginning of the year that cars should not pass the MoT. Presumably, we are coming to the end of the year and there should be quite a sizeable number of vehicles that we are aware of.

**Mike Hawes (Chief Executive, SMMT):** It should be considered, certainly. I am not an expert on the exact law around the tampering.

**Murad Qureshi AM (Deputy Chair):** It is serious enough to warrant that. It is just whether the police have the resources. That might be something we may want to recommend in our report.

The second thing is just coming back to the Euro 6 standard itself. Some people have presented it as a silver bullet and I am just not sure what I am hearing from you and our academics. How cautious do we have to be on that front?

**Mike Hawes (Chief Executive, SMMT):** I would not describe it as a silver bullet, first of all. A silver bullet would fix the problem instantly and it will not. As I said, just listening to some of the evidence around the latest studies, Euro 6 goes a tremendous way to addressing the problem, certainly on PMs. However, as the science evolves and listening to some of the discussions around black carbon, clearly, that science is in progress and that science will inform regulation. It is then likely that regulation would follow to make ever more stringent tests.

As manufacturers, we have to balance and we need to address - as in the first point I made - the different challenges around vehicles in terms of carbon emissions, in terms of air quality emissions and in terms of ever increasing safety, which are often at odds with one another given the weight impact. We have to do that while also ensuring that vehicles are affordable either to private retailers or to business if you are talking about commercial vehicles and heavy goods vehicles. That is the constant balance we have because I would argue that as an economy we still need to move goods and people around and we have to maintain the affordability of vehicles as well. So Euro 6 is not a silver bullet but what it has done is gone a hell of a long way to addressing a large part of the emissions. It will get ever-tougher under the testing of the real-world emissions, which will form part of it over the next three years.

Secondly, it is being introduced without a significant reduction in fuel economy. If you look at some of the vehicles that already have Euro 6 on them - and I am thinking about buses - and if you flip up the back of a bus, the what Ian [Bacon] describes as the Euro 6 'chemistry set' that is sitting next to the engine is about the same size as that engine. Clearly, you can see the investment and at least the weight penalty that that additional technology has. To be able to bring vehicles to market without a reduction in fuel economy takes a

lot of engineering investment. I will go back to the point I was making, we need to try to make sure that these technologies are introduced whilst maintaining affordability.

**Murad Qureshi AM (Deputy Chair):** I am hearing from the manufacturers that it is not a silver bullet for public policy. Is that what I am going to hear from the academics as well?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Yes. I would not disagree that Euro 6 diesels offer a big improvement over Euro 5. From our remote sensing work - and you can currently buy Euro 6 diesels in advance of the legal requirement - so far, the estimates we have made and the measures we have made and some other published numbers from elsewhere in Europe suggest maybe a 40% improvement in NO<sub>x</sub> emissions or maybe more from Euro 6 compared with Euro 5. There still remains the question of the primary nitrogen dioxide as part of that fraction, which is still an issue to be addressed.

The other important point of course is that just focusing on the linear track of improvements in diesel regulation is only one part of the problem. We need to look across the technologies and Euro 6 petrol cars, for example, we do not have measurements on because they are few and far between on the street. However, extrapolating from our measurements on Euro 5 petrol, we have made rough estimates that a Euro 6 diesel might emit as much as five times the NO<sub>x</sub> that a Euro 6 petrol or gasoline car would emit when you are looking at choices going forward. That figure would probably equate to the relationship between a Euro 6 diesel and a petrol hybrid as well.

**Murad Qureshi AM (Deputy Chair):** I am not sure how car owners are sufficiently aware of that. Frank, do you have anything to add to that?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Just the obvious. The vehicles will need excellent maintenance if they are going to keep performing. That has been an issue all along. Secondly, the penetration of these vehicles into the fleets takes considerable time. We were all sitting here probably four or five years ago having similar discussions and we really have not moved on.

There is no easy solution here. I was asked if we would ban diesels, but we would not have any buses or any taxis on our streets if we did that tomorrow and we cannot do that, but what we have that is coming forward is going to frustrate us as well. That is the reality of the situation.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Can I just add a small point on this question of banning diesel and if you were to do that? One thing that we have not touched on yet is that if you were to imagine a blanket ban on diesel, one development that is emerging in the number of so-called gasoline direct injection (GDI) vehicles that are coming on to the market as a means of improving the fuel economy of gasoline-fuelled vehicles. Colleagues here can give you the technical details, but essentially what you try to do is make a gasoline engine work like a diesel with the consequent downsides of potentially higher particle and NO<sub>x</sub> emissions. The Euro 6 regulations cover this, but you might well end up going down the same route through banning diesel but allowing GDI vehicles with similar kinds of issues to be addressed.

**Mike Hawes (Chief Executive, SMMT):** Can I just add something to that? Martin is correct. GDI does have that downside. Again, we go back to that trade-off between fuel efficiency and particulates. Euro 6 does address it.

However, again, if you look at some of the studies that were referred to earlier - the first one from Southern California, the studies from Sweden and the studies from Japan and China - I do not doubt the veracity of those studies but all those markets, with the possible exception of Sweden, are predominantly gasoline vehicle markets. To put that into context, banning diesels is not the answer.



**Stephen Knight AM (Chair):** Some of them use diesel for heavier vehicles.

**Mike Hawes (Chief Executive, SMMT):** Yes, which is about 10% of the fleet.

**Nicky Gavron AM:** There is something that I just wanted to clear up. In diesel, is it the per-gram emission that is so harmful or is it the quantity? How does it work?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Both, I think. Certainly older diesel vehicles produce a lot more particulates per kilometre travelled than an equivalent size petrol vehicle. However, when you look at the emissions on a per-gram basis, we have talked about there being a lot more black carbon in the diesel vehicle emission, but there is also a lot more complex chemistry and organic compounds --

**Nicky Gavron AM:** Per gram?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Per gram. That is the reason why in 2012 the International Agency for Research on Cancer which is --

**Nicky Gavron AM:** In that case, you can compare and you can look across Euro 4, Euro 5 and Euro 6 and you can see how it is declining?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** The mass?

**Nicky Gavron AM:** Perhaps.

**Professor Frank Kelly (Professor of Environmental Health, KCL):** There are two things. One is the amount of particles or the mass that is being produced and that is declining. Also, when you compare the toxicity of an equivalent mass from both vehicle types, it is changing as well. However, all the time, the diesel particulate is more complex. It is more toxic than the petrol equivalent, as far as we can see. That is why in 2012 the WHO put diesel emissions as a Group 1 carcinogen.

**Nicky Gavron AM:** It may come up later and forgive me if it does. It may be a myth, but since most of the journeys in London by car are very short journeys, ones you could probably walk in 20 minutes if you are a good walker like two kilometres or something, what I have been told is that when cars - diesel cars and it may be true of petrol, too - start up, the emissions are greater. It is the first part of the journey and therefore you are getting a lot more first parts of journeys and you are also getting traffic lights and stop-and-start and so on. Is that true?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** With the cold start of any vehicle, I believe, yes, you get higher emissions in that first period of the journey. Yes, if we could eliminate those very short journeys, it would make a very big difference in the emissions around us.

**Ian Bacon (Technical Manager, SMMT):** I will just come back on that point. There are a couple of points there. Just to deal with the cold start, since Euro 3 the test cycles were amended to make the emissions monitoring start as soon as the vehicles keyed on. Within 30 seconds, the catalyst technology is active and the emissions are being addressed; we dealt with this several years back.

In terms of the diesel issue, which was one of the questions we were dealing with, at least since Euro 5 particulate filters have been fitted effectively to meet the requirements. When we talk about all the medical

evidence, it has been addressed. The idea that the Euro standards have not delivered is not strictly true. They have done an exceptional job in dealing with the health issue, which is the most important thing that gets dealt with first.

Not only do we measure mass on the test as part of the regulatory requirement but we also have a number count as well. The regulators foresaw the next impact and that has been dealt with. Vehicles under Euro 5 and Euro 6 in terms of particulates are exceptional and that should be acknowledged. We do admit there is more work to do on the NO<sub>x</sub> side, but certainly the particulates is good and that should be acknowledged.

**Murad Qureshi AM (Deputy Chair):** How long will it be before we see zero-emission vehicles coming within the reach of ordinary drivers?

**Mike Hawes (Chief Executive, SMMT):** I would argue that they already are. It depends what you classify as an 'ordinary driver'. Figures out today, this very morning, show that the take-up of alternatively fuelled vehicles - which includes hybrids, plug-in hybrids and pure electric vehicles - is up 50% for the month and 50% this year. We are beginning to see that acceleration in the take-up of these vehicles. They still represent only about 0.5% of the total passenger car market, but that is obviously increasing. They still benefit from - and this is essential to the take-up - Government support in terms of about £5,000 of grant to encourage their take-up.

This is the beginning of a technological shift and the new technology, given the cost efficiency, is just not there yet. It does take a long time to be able to get the price down to where it is able to compete with more conventional technologies. A good example here is if you look at the Toyota Prius which was first introduced to the market in 1997 and came to the UK in 2000. Basically, sales were incredibly small for five or ten years. Then, after a number of developments in terms of both the car and the support for those types of technologies, it has begun to accelerate quite dramatically. That is fairly typical of new technology introduction within the new car market. It does not accelerate as fast as, say, mobile phone technology. It is a much more expensive purchase, it is held by most people for at least three years and it is a much slower introduction of new technology, but it is coming.

**Murad Qureshi AM (Deputy Chair):** Firstly, I am glad that you have given us the latest figures nationally, although it would be useful to have a regional breakdown, for example some London figures.

**Mike Hawes (Chief Executive, SMMT):** We will literally get the top-line figures and later in the day we will have it by region. We are about six hours too early for that.

**Murad Qureshi AM (Deputy Chair):** Something the Committee has looked into is particularly the electric vehicle side where you get zero emissions at the tailpipe. We have been to a plant up in Sunderland for the Nissan Leaf. I have also been to Birmingham and have seen a BMW demo of electric cars. The big barrier there seems to still be price. You need to give people £5,000 to buy these 'expensive cars', in inverted commas, and the key barrier there is the battery technology. Are we any nearer to tackling that?

**Mike Hawes (Chief Executive, SMMT):** If you are looking at pure electric vehicles, there are still some barriers there. You mentioned price. It is, compared to internal combustion engines, a relatively expensive technology. There are still issues about range, which are being addressed. In terms of the development of batteries, you have seen the shift to lithium batteries and away from nickel-metal hydride and others. That is part of an evolution.

As to whether and how soon we can get to the stage where a pure electric battery vehicle offers the same utility in terms of range and functionality as a more conventional vehicle, we are some years away yet. There

has not been that big breakthrough in battery technology yet, and the commercialisation of it which would allow you to have that same functionality. Of course, any breakthrough in technology is going to come at a price, so we need then also to get the price down.

**Murad Qureshi AM (Deputy Chair):** We are still looking for that mountain of lithium somewhere, whether it is on earth or off earth. It will be interesting. You did touch on something which we did also look at, certainly electric vehicles you have to make people feel confident that the juice is there to take up. Are you confident the infrastructure is in place for that take-off and that would solve half the problem?

**Mike Hawes (Chief Executive, SMMT):** The infrastructure is developing. Clearly you do not want it to be 'chicken and egg' but it often is in terms of giving people the assurance that there is an infrastructure in place and that the infrastructure and the charging point will be available when and where you need it. Obviously it also depends on where people are charging. If they are able to charge in the workplace, that means they are obviously driving to work; in London clearly not everyone does drive to work given the public transport availability. Not everyone has the ability to charge a vehicle at home if you live in a flat or whatever. There are limitations in terms of charging infrastructure and its availability to the wider population, especially urban dwellers.

We have seen this escalation of infrastructure and the Government's recent allocation within the Office of Low Emission Vehicles of £500 million was good. It did not just say, "We are going to spend £500 million on infrastructure"; and nor did it say, "We are going to put £500 million into incentives to take up vehicles". It divided the money in terms of investment and infrastructure, in terms of market incentives, in terms of research and development and also other types of vehicles as well in terms of supporting development of cleaner buses and taxis and other technologies, most recently in terms of hydrogen.

You need that balanced approach. What you do not want to do is to try to pick winners. Pure electric vehicles will have a role to play in the vehicle fleet going forward, but it is not the only technology that is going to be there. It would be wrong to put all your resources around one particular technology.

**Murad Qureshi AM (Deputy Chair):** I understand that, but the latest count I have heard on the London front for plug-in points is about 1,500 still. We still need a vast improvement on that front to make things feel comfortable with electric vehicles.

Just in terms of technology, it appeared to me certainly that in some ways the technology is there. It is just critical things still need to happen and the industry is ready to respond. The Nissan is at one end of the market and BMW is at the other end, for example. Is that a fair assumption?

**Mike Hawes (Chief Executive, SMMT):** Yes, every single manufacturer is investing in a range of different technologies. That is driven not just by the need to meet some very stringent regulations but it is also driven by consumer demand. At the moment there is a comparative handful of vehicles available. It is growing rapidly; there are about 20 models or something now which would qualify for the grant. You will see the majority of manufacturers coming to market with plug-in hybrids in particular, which give you that flexibility to be able to operate in a pure electric mode within say an urban area and then in more conventional mode outside of that. That offers the practicality that most customers crave when they are purchasing a vehicle. As I said before, it is not just about having one type of driving experience.

The other part of the argument is making sure we as an industry and other stakeholders educate customers into purchasing the right type of vehicle for their driving needs.

**Stephen Knight AM (Chair):** Can I interrupt this session just for a second to welcome pupils from Christchurch Primary in Havering who have come and joined us in the public gallery? Thank you very much for coming and I hope you will find this session of interest.

**Murad Qureshi AM (Deputy Chair):** Yes, I am just on to my final thought on private vehicles. The other kind of barrier is that for most people when they are buying a car it is not a new car, it is a second-hand car. What are going to be the barriers there to push this market of new vehicles into that arena?

**Mike Hawes (Chief Executive, SMMT):** It is primarily price. The arguments that are currently limiting the take-up of these new vehicles is partly supply in terms of developing these models within the market and the price and the practicality of them. That equally applies for the second-hand market. However, it works its way through. Given that the average vehicle is on the road for 13 or 14 years, it does work through.

**Murad Qureshi AM (Deputy Chair):** Are these hybrids and electric cars depreciating more quickly or less so than your petrol car? Has that been established yet? Or diesel cars?

**Mike Hawes (Chief Executive, SMMT):** When you bring a car to market, especially new technology, you work very closely with the organisations which determine the residual value which is clearly a science and is about demand. Where you have vehicles which offer a tremendous opportunity - and, for instance, again I will go back to the Prius - the introduction of the Prius and the benefits it had in terms of accessing the Congestion Charge area without paying made sure that that had a very high residual value. Clearly the benefits that these new vehicles have in terms of running costs still carry forward into their second-hand use and they tend to have quite a high residual value because the benefits are still there.

**James Cleverly AM:** Yes, I was curious about the increase in uptake of electric vehicles. Actually, I will broaden this out to rather than just electric vehicles, as you say, perhaps alternative fuel vehicles in the broadest context. You indicated that we have gone through that kind of 'foothill' period before the 'hockey stick' that you would normally expect with technology introduction. How close are we to that 'hockey stick' element or would you say we are there by virtue of the figures you have released today?

**Mike Hawes (Chief Executive, SMMT):** We are not there yet because the biggest indicator is still that the price of these vehicles is still high. It will be probably five to ten years before they are at a comparative level. Again, that is predicated on how quickly you get these new cars into the market.

The investments all the manufacturers are making are significant. If I give you one fact, Europe's biggest car manufacturer is Volkswagen and it said it is at the situation now whereby for every additional gram it needs to save in terms of meeting regulations, it costs them €100 million. That is the level of investment you need to make. It is certainly the low-hanging fruits being picked. You are now looking to develop new technologies which will depend not just on supply but also on infrastructure and other stakeholders in the equation, not least if you are talking about plug-in hybrids, which is probably the area that is going to have the biggest growth. It does put more demands on the energy infrastructure, not just in the delivery but upstream as well.

You are right. It is crystal ball gazing and it is very difficult to pin down. However, certainly for the next three to five years it still needs a lot of support.

**James Cleverly AM:** I say 'crystal ball gazing' slightly tongue-in-cheek because the simple truth of the matter is people buy the cars that the motor manufacturing industry want us to buy. They do not produce the cars that we ask for; we ask for the cars they produce. That is fair, really, is it not?

**Mike Hawes (Chief Executive, SMMT):** I would say the manufacturer is trying to develop cars which are going to appeal to consumers, which is why they are exploring new niches. You have to respond to the customer and the customer invariably wants that practicality.

**James Cleverly AM:** You say you have to respond to the customer. What is the typical technology lead time on a technological shift for a vehicle? We are not talking about months. It is years, is it not?

**Mike Hawes (Chief Executive, SMMT):** Most manufacturers will put the development cycle at about four years. You get a new model every four years. For the premium end, it tends to be maybe six to seven years.

**James Cleverly AM:** The point I am making is that the stuff the industry has been working on over the last three, four, five, six or seven years are the vehicles we are going to buy. They are not going to throw away seven years of technology because we have taken a turn to the left in terms of our appetite for motor vehicles. I want to know when the motor manufacturing industry particularly wants us to buy electric vehicles in significant numbers? That is when it is going to happen, is it not? At what point are we going to see that competitive set of alternatively fuelled vehicles hitting the market? At what point are we going to be really hit hard with lifestyle advertising telling us that if you are cool and good looking you are going to be driving an alternatively fuel vehicle? That is when we will start buying it.

**Mike Hawes (Chief Executive, SMMT):** You are already seeing it with the legislation that is already in place at a European level to average 95 grams across the industry by 2020. To achieve that you need an increasing proportion of alternatively fuelled vehicles, be they hybrids, especially plug-in hybrids, as I said, or battery-electric. There is no way that the industry can meet that purely based on internal combustion engines.

**James Cleverly AM:** It is not going to take us 600 years?

**Mike Hawes (Chief Executive, SMMT):** No. If you talk to each of the manufacturers, clearly they will not tell you exactly what models are coming when, but they certainly would not have any hesitation in telling you about the investments that have been made in those new technologies.

**Nicky Gavron AM:** I want to talk just for a moment about plug-ins and energy, but it is not just due to the market, is it? It is due to regulation incentives and the whole range of ways that policy can enable and shape markets.

**Mike Hawes (Chief Executive, SMMT):** Yes.

**Nicky Gavron AM:** We are not talking about that at the moment, but it would accelerate things enormously if we were to do that. Can I just ask you about the plug-in and energy infrastructure? I understood - and I might be wrong - that it is not just electric cars but plug-in hybrids also that you said they were a toll on the energy infrastructure. If they take the electricity off at night when there is not peak demand, that helps the energy supply, does it not?

**Mike Hawes (Chief Executive, SMMT):** It smoothes the demand, yes.

**Nicky Gavron AM:** 'Smoothes the demand'. I knew there was a technical phrase. There is a battery involved, yes?

**Mike Hawes (Chief Executive, SMMT):** Yes.

**Nicky Gavron AM:** Can you not store it? Can you not also put it back into the grid if you want?

**Mike Hawes (Chief Executive, SMMT):** You are absolutely right. There is potential around that.

**Ian Bacon (Technical Manager, SMMT):** There is one concern. As a practical example, maybe you plug your phone in at night. If the grid was taking energy back off your phone and your phone battery then failed several years early because the grid has been using it, would you be worried about that? That is the issue. The vehicle is expecting the battery to work for its use and obviously, if you are forcing energy in and out of the battery, you will be fatiguing the battery. It is a very neat idea, but it needs a lot more development.

**Nicky Gavron AM:** We should explore the link between energy supply.

**Stephen Knight AM (Chair):** Can I ask our witnesses from the motor industry? You mentioned that the Prius has been around for more than a decade now. I just wondered why it is that European manufacturers seem to be almost a decade behind the Japanese car manufacturers. Look at Toyota and Nissan, which obviously has the Leaf now, and Honda has done a lot of hybrids as well. Why is it that Japanese manufacturers seem to have embraced new alternative fuel vehicles many years before European manufacturers? Is that because of regulation in Japan versus Europe or is it appetite for new technology? What has driven that?

**Mike Hawes (Chief Executive, SMMT):** The manufacturers invested and continue to invest in new technologies. The Japanese were the first to go down the hybrid route, led by probably Toyota and Honda. European manufacturers tended to develop even more fuel efficient diesels because that is the technology in Europe. Hybrids took an earlier foothold in the USA as well, not just because of the Japanese cars but some of the American cars. Again, they are gasoline markets. Japan is a gasoline market. The USA is a gasoline market. The development of technology lent itself more readily to gasoline-electric hybrids.

I would not say the Japanese were investing more in new technology. They just chose that particular route perhaps earlier. Other manufacturers are there now as well. It could be any manufacturer that identifies the next breakthrough technology because they are all looking for it.

**Stephen Knight AM (Chair):** In terms of air pollution, the Japanese going for petrol hybrid as a technology solution certainly was a better punt, in terms of air quality, than the European manufacturers going for ever more carbon efficient diesels. We know that that choice has had a big impact on our air quality, has it not?

**Mike Hawes (Chief Executive, SMMT):** The investment in diesel has had to coincide with investments in cleaner diesel, too. It is not a zero-sum game. You have to make sure you address --

**Stephen Knight AM (Chair):** Clean-air diesel, I guess. Can we move on then to Len, who is going to lead some questions around what we can do immediately to reduce diesel emissions?

**Len Duvall AM:** We have talked about the longer term issues around that. Maybe we can talk about short-term and medium-term issues. You talked in terms of fiscal leverage and of making people change their behaviour. On the issues around Fuel Duty and the relative rates between petrol and diesel, would that make a real difference in terms of nudging people around changing or upgrading cars? Particularly I would like to hear about the views around city diesel and biodiesel. Is this really cleaner diesel or is this something we are all holding on to thinking it will make a real difference to our air quality in the future? Shall we start with the industry first?

**Mike Hawes (Chief Executive, SMMT):** The UK has traditionally put duty parity between gasoline and diesel and that has served it well.

Clearly with diesel, it is the fuel of the commercial sector. You have to always balance the importance of keeping costs under control in terms of logistics companies, delivery companies, commercial or otherwise. The duty issues are clearly always very sensitive issues. If there is an adjustment in Fuel Duty, it does have a very quick bottom-line impact on business and you need to tread very carefully around there.

In terms of the ways of encouraging take-up of alternative vehicles and improving emissions, yes, you can look at fleet renewal schemes. In terms of immediate impact, you need to also look at congestion. Clearly, from the studies that are referred to where you do the roadside monitoring on congested roads, being able to keep the traffic moving has a significant impact on air quality.

Also, the introduction of these new technologies. If I can refer to the bus sector, TfL's own studies around the 159 bus route, which has Euro 6 busses on it, is showing tremendous reduction in both PM and NO<sub>x</sub>, something like 90% something on that route using TfL's own figures. It is getting the new technologies out there and trying to keep the traffic moving. The more you keep it moving, the more efficiently these technologies operate. Then it is also looking at other sorts of incentives for that take-up.

**Len Duvall AM:** There is still the problem of even keeping traffic moving. The problem around the diesel issue is that maybe outside in areas where there are longer runs we are not seeing the dis-benefits of diesel in terms of the impact on people's air quality. The issue is that even if we keep traffic moving here in London, it would work on certain roads but we would still be left with the same problem around poor air quality and some of the particular issues that diesel gives.

**Mike Hawes (Chief Executive, SMMT):** If you can keep the traffic moving, the technologies work much more efficiently. Obviously, stationary traffic is the major problem because it just sits there and it builds up. Stop-touch-start technology can help address some of that. Certainly in the bus network they are looking at geo-fencing when you have that ability to run in different modes in areas. That is a good way of addressing that quickly.

**Len Duvall AM:** Do you think you are incentivised either by regulation to speed up some of the issues around moving faster towards these cleaner technologies and cleaner fuels?

**Mike Hawes (Chief Executive, SMMT):** There is always a combination. Consumers respond better to incentives than obviously regulation, I would probably argue. We have not discussed London's Ultra Low Emission Zone (ULEZ) yet and there is tremendous potential to use that to encourage change in purchasing patterns.

**Len Duvall AM:** What do you think would be the impact on your industry if we widened the ULEZ, rather than just contained it to a central zone, and said, "Actually, all of London deserves an ULEZ because of the air quality that we have"? Would that be a sufficient nudge to your colleagues in the industry to move slightly faster, as well as a nudge to consumers?

**Mike Hawes (Chief Executive, SMMT):** We can only move as fast as the consumer. We can develop the technologies and introduce them, but we are still dependent on consumer take-up, which is why you have the incentives and so forth. If you were to expand it, then clearly there would be an impact in terms of potentially new vehicle sales, because increasing numbers of people may be forced to purchase new cars. You would have to consider the affordability issues and the social equity aspects because not everyone can afford a new vehicle which would meet the standards that are being required.

**Len Duvall AM:** Shall we turn to the fuels, then? What is the biodiesel and city diesel that we hear about?

**Ian Bacon (Technical Manager, SMMT):** Sometimes it is terminology that oil brands use. Certainly a few years ago, the sulphur content of diesel was reduced, which was necessary to bring in the cleaner diesel technology such as the DPFs. With biofuels, it is not necessarily a direct link at all to air quality. This was purely for a CO<sub>2</sub> benefit. From an auto industry point of view and at a regulatory level and a design level, we design the vehicles to run up to a B7 - that is the 7% biofuel and the pump fuel you see on the market. The benefit of running the biofuels is that if they have been sustainably sourced there is a net saving of carbon. However, if they are of good quality they should not have any impact on air quality, negative or positive. They should just be as mineral fuel. We would obviously encourage that to stay that way.

**Len Duvall AM:** From an academic perspective on what you have just heard, are there any other short-term measures or would you like to comment on what you have heard? Actually, what can we do to make life better for Londoners in terms of their air quality and dealing with really particular issues with diesel, short-term rather than long-term?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** You started off the question by talking about fiscal measures and so on. They are clearly a set of levers. Actually, there are quite a few there that you could pull. A lot of them operate on a national level, of course. You would have to convince the Treasury of them. There are significant measures that you could take. Fuel Duty is one. The caveats were already mentioned but nonetheless that is a potential lever. Vehicle Excise Duty (VED) is another. You have heard about how successful the incentive scheme has been for hybrids and so on. You could think of it in reverse. They may not be symmetrical. You may need to do more to discourage people. You could play with VED, potentially. Company car tax is another thing; you could dis-incentivise diesels through company car tax.

Then local measures of course are the ULEZ, the Congestion Charge and so forth. You could actually think of being a little bit more forensic in terms of the structuring of the disincentives there, for example, the proposals on the table at present that still in effect allow Euro 6 diesels in. You might actually think about looking at that again and even installing disincentives for Euro 6 diesel if you felt that was an appropriate thing to do. That is another measure that you could take in London. The current proposed standards for the ULEZ would charge diesels up to and including Euro 5. What I am saying is you could think of extending that to have the charges for Euro 6 diesels as well. You could even --

**Jenny Jones AM:** Yes, that is a good idea.

**Len Duvall AM:** We talked earlier on about the conversation about banning diesels. You said, "Hold on. There are other bits of pollutants that we need to deal with as well". I thought that was your contribution. Would actions such as this need to be combined with tackling those other pollutants? You could not just do diesel on its own or would it be a stepping stone towards that? In terms of health impacts, there must be a tipping point when opinion formers or policymakers say, "Actually, enough is enough". We saw that with cigarettes. We see that. We are going to see that with the sugar debate on health impacts. What is the tipping point for the health impacts around diesel pollutants and these other pollutants around our air quality and the impact they are having on people's lives?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** The first point to remember is that there is no such thing as a zero-emission vehicle. We have been talking about that. We are talking about zero-emission from tailpipe. Every vehicle will produce PMs from its tyres, its brakes and its road wear. That is an issue which is becoming proportionally more important as we drive down the tailpipe emissions with legislation. As long as we have hundreds of thousands of vehicles coming into London and moving around London and all of our cities, we are going to have an air pollution problem. That is the first thing. That is why I was saying that that is the magnitude of the problem. At the moment we do not comply in the UK for



nitrogen dioxide and we now know that nitrogen dioxide is having at least equivalent health effects as small particles.

If we are going to deal with that issue, what can we do? It pushes us directly at looking at diesel emissions in our urban areas. If we bring in measures, as we have been discussing and as Martin [Williams] has gone through, which reduce the emissions from diesel vehicles either by outright bans or by hybrid vehicles working in certain areas where we have problems, then that is a step in the right direction. Ultimately, we need a form of much cleaner public transport in our cities.

The tipping point is when the public understanding of the issue reaches a sufficient level, as it did with cigarette smoking. That took 40 years. We are probably at about year seven or eight with the public at the moment with this particular issue. When they realise what it is doing to their health and what it is doing to their children's health, we will get to that point.

The other thing I would like to say about biodiesel is that we must remember that, yes, it may give us a climate change benefit, but the emissions of biodiesel are equivalent from a mass point of view. Some of the early toxicity studies have suggested, in fact, the particles may be slightly more toxic than fossil fuel diesel. That is an ongoing area of research.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** One thing is that we have talked a lot about looking forward and the benefits of Euro 6 gasoline, about diesel and so on. What we must not forget is that there are an awful lot of older dirty diesels still out there. If you are talking short-term actions, then something needs to be done about those. That is a tricky one.

I actually went on public record on the BBC welcoming the floated idea of a scrappage scheme because I thought that was the first time that any policymaker had actually addressed the issue of the old diesel fleet. You need to look hard at scrappage schemes. Some years ago when I was in Government, we looked at that when there was a backlog of vehicles out there that the motor trade could not actually sell. We looked at scrappage schemes. They did not seem to be terribly effective and the returns were not great. However, that whole issue of how you deal with the existing fleet is a big problem. Any silver bullet you can find is to be welcomed.

**Murad Qureshi AM (Deputy Chair):** Just on that point, actually, there was a scrappage scheme in 2008/09. It was not actually aimed at diesel. It was not actually aimed at air pollution. It was to help the car industry effectively.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Exactly, yes.

**Murad Qureshi AM (Deputy Chair):** It did get rid of something like 300,000 vehicles nationally. Approximately, I would have thought, 10% of those were in London. Surely there are things to learn from that.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** That was my point.

**Murad Qureshi AM (Deputy Chair):** It was done by the Department for Business, Innovation and Skills.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** That is right. That was my point.

**Mike Hawes (Chief Executive, SMMT):** You are right. It was successful. Its objective was not environmental. That was a benefit of it because clearly you were replacing old what are called 'clunkers' with

new vehicles. There were, you said, around 300,000 vehicles. We would argue that it was a net benefit to the Exchequer because the incremental sales in terms of VAT revenues more than outweighed the £1,000.

**Murad Qureshi AM (Deputy Chair):** The irony now is you have *The Sun* newspaper keen to push something like that and we have the Mayor backing that as well. It is something very much in line with Labour policies in the previous Government.

**Mike Hawes (Chief Executive, SMMT):** You need to be careful, as Martin [Williams] said, around scrappage schemes because clearly the air quality problem is a huge in urban areas. If you are going to develop a scrappage fleet renewal scheme, you need to make sure it is going to address the problem. That means focused on an urban area. Again, do you focus it on private passenger cars? Do you look at heavy goods vehicles or commercial vehicles? The 2008/09 scheme had a matched contribution from industry. When you are looking at, for instance, heavy goods vehicles, given the cost of those vehicles and the price, it would be a significant investment but it would deliver Euro VI vehicles onto the road much more quickly than it would do otherwise.

**Gareth Bacon AM:** Buses are an interesting contributor to this debate. In the last decade and a half, obviously there has been exponential bus use increase, particularly in central London but in greater London generally. It is not environmentally trouble-free, of course, because the TfL bus fleet contributes significantly to NO<sub>x</sub> emissions, less so to PM10, but it does make a significant contribution too. The good news is, of course, that TfL can be a key player in doing something about that. What does the industry offer London in terms of wanting to clean up its bus fleet?

**Mike Hawes (Chief Executive, SMMT):** We would argue that it is already on the way to doing that in terms of some of the trials that are already going on. As I said before, it is on the 159 route where they have Euro 6 buses running on that and TfL's own data shows that is making a significant reduction both in PM and NO<sub>x</sub>. You are also seeing some introduction on a trial basis of electric vehicles and electric buses. That technology lends itself at the moment only to probably single-decker. It does not quite lend itself to double-decker yet.

**Gareth Bacon AM:** Why not?

**Mike Hawes (Chief Executive, SMMT):** It is the efficiencies of battery technology and the weight you have to carry. Obviously the additional capacity requirements of a double-decker mean that you would be hauling around a hell of a lot of weight and batteries.

The technologies are being developed and they are being introduced. London in particular clearly has a tremendous opportunity here and is taking that. Obviously the London bus is iconic. London often sets the standards which are followed in other provincial cities. The introduction of these new technologies - specifying Euro 6 for your fleets and increasingly seeking other forms of new technologies, hybrid buses and buses with geo-fencing - all of those things can be brought to market. Best of all, they are being brought to market by British companies because, as we know, the UK bus market is British in name and British in manufacture.

**Gareth Bacon AM:** Could you outline me the merits of the debate between hybrid buses and the Euro 6 standard buses?

**Mike Hawes (Chief Executive, Society of Motor Manufacturers and Traders):** I do not see them at odds with one another. They can be complementary. Euro 6 is already mandatory for production of buses. You have then the market aspect whereby operators are clearly looking to reduce their pence-per-mile and pence-per-passenger rates and will look for other technologies. Again, it comes back to market economics.

Driving down the cost of that technology will help make it more affordable to get more of those vehicles on the road. The more that TfL specifies the technology, it will become then a requirement for the fleet operators to purchase.

Actually, one of the issues we did not touch on earlier is that there is a real role for public sector procurement in getting new technologies visible on the road because that sends the right message to private consumers, too.

**Gareth Bacon AM:** One of my colleagues on the Assembly is particularly keen on hydrogen as a solution to the emissions problem. Do you have a view on that?

**Ian Bacon (Technical Manager, SMMT):** It is certainly one of the technologies that we are looking at. Actually, on the Automotive Council we have set up road maps and hydrogen technology is certainly on there. There are issues.

**Gareth Bacon AM:** Could you outline the issues, please?

**Ian Bacon (Technical Manager, SMMT):** Cost is significant.

**Gareth Bacon AM:** Why?

**Ian Bacon (Technical Manager, SMMT):** Effectively, a hydrogen vehicle is an electric vehicle with a bolt-on hydrogen conversion to electricity at one end of it. You have the cost of the electric vehicle and then the additional cost of the hydrogen fuel cell and storage on there. It is perfectly feasible, but then it links into the classic question that we need clean hydrogen. Once we have an available fuel stock of hydrogen, then we are up and away and someone has to pay. If Government and local authorities can afford the cost of the product, I am sure original equipment manufacturers would be quite interested in developing it further and faster. At the moment, they are cost-limited and limited in application.

**Gareth Bacon AM:** What would you say the prospects are for zero-emission bus technology in the near future? When I say "the near future", I mean within the next five years.

**Mike Hawes (Chief Executive, SMMT):** Again, I am crystal ball gazing. It is challenging, as we said before, with the cost and some of the energy density issues of some of the alternative fuels and indeed lifecycle cost. If you want a zero emission you have got to look at the whole lifecycle of some of these newer fuels. There is a prospect and London is really trialling - I will use the phrase - zero emission from tailpipe vehicles and buses. Being able to get them across the fleet is still some years away.

**Stephen Knight AM (Chair):** You mentioned that there were some Euro 6 buses being trialled on route 159 in London. In theory, the Euro 6 regulations for new buses have been in force from 1 January 2014, have they not?

**Mike Hawes (Chief Executive, SMMT):** On the manufacture of buses, yes.

**Stephen Knight AM (Chair):** On the manufacture. So far, we have only a few of them on the road, if any at all. A lot of the buses coming on stream this year have been Euro 5, have they not? How long does it take from, in theory, the regulations applying to the manufacture of new buses to when they actually hit the road? Are manufacturers stockpiling Euro 5 engines so that they can carry on selling them for years to come?

**Mike Hawes (Chief Executive, SMMT):** On the contrary, having invested in Euro 6 technology, they will want it to be out there and sold to fleet operators as soon as possible. That can only be at the behest of either legislators requiring it when they specify the procurement or the operators themselves purchasing those buses, given they will have a fleet renewal cycle.

**Stephen Knight AM (Chair):** Presumably, what limits the ability of having the buses on the road is the manufacturers gearing up to manufacture them early enough.

**Mike Hawes (Chief Executive, SMMT):** The bus manufacturer is producing Euro 6 now. That is the standard for new models.

**Stephen Knight AM (Chair):** Should you not have been producing them last year so that they could be on the road from 1 January 2014 when the standards came in?

**Mike Hawes (Chief Executive, SMMT):** Some of them would have been doing that. However, fleet operators will be aware that when you have a change of technology, it does increase the price.

**Stephen Knight AM (Chair):** You are telling me that fleet operators would prefer to buy Euro 5s that are still sitting there and that were manufactured last year because they are going to be cheaper than the Euro 6 that they will have to buy?

**Mike Hawes (Chief Executive, SMMT):** I will give you a corollary. For truck manufacturers, Euro VI has been mandatory since 1 January 2014. As you would expect, truck sales tend again to be fleets and there was a massive spike last in the last six months or the last quarter of last year. Sales this year in the first six months fell off a cliff. It is beginning to come back because you cannot delay the fleet renewal and purchase forever, but clearly there was a step-up in price from the old technology to the new.

I referred to just the sheer scale of investment that is needed and that goes onto the back of a bus or the back of a truck. It is a significant increase in cost, not offset by increased fuel economy. It is a marginal improvement in fuel economy. That was the real achievement of the industry. However, invariably, any fleet operator in any sector is going to operate on a commercial basis. Therefore, the purchase pattern would obviously reflect a telegraphed increase in price.

**Nicky Gavron AM:** Can I just ask whether it is better to go for a Euro 6 or a diesel hybrid? Can you have a petrol hybrid for a bus?

**Ian Bacon (Technical Manager, SMMT):** There is a little bit of confusion creeping in. The Euro standard applies to the engine on the bus. Any new hybrid bus will have a Euro 6 engine because it has to. We cannot sell one legally into the market and all hybrids from this point forward will have to have a Euro 6 engine.

**Nicky Gavron AM:** They cannot have a petrol engine? It has to be a --

**Ian Bacon (Technical Manager, SMMT):** They can certainly have a petrol engine.

**Nicky Gavron AM:** Why is TfL not considering petrol hybrids, then?

**Ian Bacon (Technical Manager, SMMT):** You would have to ask TfL.

**Jenny Jones AM:** Yes, quite. It is a shame they are not here.

**Nicky Gavron AM:** No. I just have never understood why we are going for diesel hybrids when we have known now for a number of years that we should not be really pushing diesel.

**James Cleverly AM:** It is the torque. Petrol engines do not provide enough torque to shift a vehicle that big.

**Ian Bacon (Technical Manager, SMMT):** That is exactly the point. The engine characteristics of a diesel suit the hybrid application very well.

**Mike Hawes (Chief Executive, SMMT):** Larger vehicles - be they heavy goods vehicles or buses - depend largely on diesel engines, given the performance characteristics, as Mr Cleverly mentioned. The fuel economy penalty on gasoline would be huge.

**Nicky Gavron AM:** If all the cities joined together, they would be able to perhaps bring down the price of certain kinds of buses. Are you seeing that across Europe?

**Mike Hawes (Chief Executive, SMMT):** It is too early to tell in terms of the Euro 6. Certainly London, I know, in setting out the procurement framework, would specify Euro 6. Those are commercial contracts and I would not have visibility of those, but other provincial cities would likely follow.

In terms of public procurement in general, we are not just talking public transport. Governments and the public sector operate huge fleets of vehicles be it the National Health Service, be it police forces. Again, they are large purchasers of vehicles and can influence market take-up. One of the other barriers to take-up is basically acceptability. When you see a new technology on the road, there are always the early adopters in terms of private purchase, which is a small proportion of the buying public. The more newer technologies are seen the quicker they become accepted. People are firstly aware of them and secondly realise they should be investigated as a potential benefit.

**Jenny Jones AM:** The ULEZ is due to come in in 2020. Putting aside all your concerns about the political impacts - which is something that we would have to deal with - what would your advice be, having looked at this scheme? Should it be bigger and sooner and possibly stricter, for example, including Euro 6 vehicles? Would that be your advice?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** Yes.

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Yes.

**Stephen Knight AM (Chair):** That was very clear. Can I drill into the answer we heard just now about the difference between diesel hybrid buses and ordinary buses in terms of their emissions? You said that there is no difference if it is a Euro 6 standard bus whether it is a diesel bus or diesel-electric hybrid. In terms of its emissions, they would be broadly the same?

**Mike Hawes (Chief Executive, SMMT):** They have to meet the standard.

**Stephen Knight AM (Chair):** They have to be within the same limits?

**Mike Hawes (Chief Executive, SMMT):** The hybrid gives you normally the ability for zero-emission running.

**Stephen Knight AM (Chair):** In the light of that, is there any rationale at all for an ULEZ which has as its criteria for an ultra-low emission vehicle merely that the bus is hybrid rather than that it meets a particular Euro

standard? In the proposal from TfL for double-decker buses, the criteria they are to meet is simply that they have to be hybrid rather than meet Euro 6, for instance?

**Mike Hawes (Chief Executive, SMMT):** They would by law have to meet Euro 6 if you purchased them now.

**Stephen Knight AM (Chair):** New vehicles, yes, obviously.

**Mike Hawes (Chief Executive, SMMT):** The ULEZ comes in in 2020. The only vehicles you will be able to buy will be Euro 6.

**Stephen Knight AM (Chair):** Indeed, but there will be buses on the roads in 2020 that were bought before Euro 6. Indeed, for the New Bus for London, all 600 of the New Routemaster buses that are arriving on our streets right now are Euro 5 - not Euro 6 - compliant. Certainly the intention is those will still be running as part of the ULEZ. Professor Williams?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** The proposal for the ULEZ in terms of hybrid double-deckers says "in central London". That is back to the question of the size of the ULEZ. It may well be if there are a lot of routes that go through the ULEZ anyway that you could argue that the whole of London's buses are going to have to be hybrids. It may not necessarily be the case. That needs looking at.

Secondly, harking back to the question of Euro 6, it is a plea for a more forensic look in terms of research because, although the Euro 6 vehicles will have to meet the NO<sub>x</sub> standard, as I said earlier in my introductory remarks, our current work, which will soon be published, suggests that even though you may have very similar NO<sub>x</sub> performance from a range of different manufacturers and after-treatments and the chemistry set at the back of the bus, you can get wildly varying nitrogen dioxide in that NO<sub>x</sub>. That really does need careful choice.

Plus there is the fact, of course, as Mike [Hawes] has already said, that in congested driving, the after-treatment chemistry set does not work as well as it perhaps ought to do. There are reasons to look hard at the actual performance in the real world of Euro 6.

**Stephen Knight AM (Chair):** It may not be good enough.

**Nicky Gavron AM:** Is a diesel hybrid - with Euro 6 being the diesel bit - lower on pollutants than a pure diesel?

**Ian Bacon (Technical Manager, SMMT):** It would depend on the route but clearly, if the bus is able to drop into electric-only range for that proportion of the time, it will be producing zero tailpipe emissions.

**Nicky Gavron AM:** It has to be better, has it not?

**Ian Bacon (Technical Manager, SMMT):** Of course, yes.

**Nicky Gavron AM:** Why are we not accelerating changing the fleet to diesel hybrid? We have been talking about it for years and years.

**Stephen Knight AM (Chair):** Does the emission standard it has to meet merely refer to the time the engine is running or is it an average? In other words, could you have an engine that is slightly dirtier but because it is

not running as often it meets the overall standard, whereas a pure diesel engine would have to be cleaner? I do not know. Do you get the point of the question?

**Ian Bacon (Technical Manager, SMMT):** I understand. The answer is no. I will just explain that to give it some context because of the question. All the engines have to meet the Euro 6 standard. That means when they are running they have to meet the standard. You cannot make the engine dirtier because it has the hybrid system to fall back on and that cannot happen. The engine will always be clean while it is running.

What the hybrid system allows you to do is further optimise the efficiency of the overall bus and when it does not need the engine you can switch it off. It has a couple of added benefits where it stays warm and reduces noise and this is where the geo-fencing idea comes in. In a highly populated street, you can drop the vehicle on to electric only range because it should have enough power to creep the vehicle at the speeds you will see down Oxford Street. It is a very interesting technology and something that is available now. The products are there. It could be done.

**Stephen Knight AM (Chair):** This gets back to the original question some moments ago, which is whether a hybrid bus of the same Euro standard as a diesel bus is better in terms of emissions or worse or no better or is it the same?

**Ian Bacon (Technical Manager, SMMT):** It is going to be better.

**Stephen Knight AM (Chair):** We are being told that potentially it could be better because the engine will not be running all the time.

**Ian Bacon (Technical Manager, SMMT):** As often.

**Stephen Knight AM (Chair):** I do not know if you have any quantitative studies that demonstrate that. I do not know about our academics. Professor Williams, do you not know of any?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** Not published yet. I would need to check to see how many diesel hybrid buses we actually sampled in a study we have just done.

**Ian Bacon (Technical Manager, SMMT):** This is the irony of the roadside monitoring. They will come up with zero results because they will not be polluting. It is really important you only study that what is actually captured is that that was a zero result, not a false result, because the vehicle will not be emitting. This is why we have to be very careful with roadside monitoring. You need to understand how the vehicle is being operated at that snapshot in time.

**Murad Qureshi AM (Deputy Chair):** Can I just raise a few issues on buses? Firstly, Mike [Hawes], thank you for reminding me of the 159. I used to go to school on that bus and it sounds as though I should get on it and experience diesel hybrids, although I do not think it takes the same route as it did then.

Whilst we are on buses, can I just ask a few questions about Oxford Street because the buses are the key pollution driver there? In light of the recent letter to the Principal of KCL regarding [Dr David] Carslaw's [Principal Air Quality Scientist, Environmental Research Group, KCL] work, could I ask Frank, if you do not mind me putting you on the spot, what your reaction was when you heard the Mayor label Dr Carslaw's claims on Oxford Street as rubbish.

**Stephen Knight AM (Chair):** They were rather more colourful than 'rubbish'.

**Murad Qureshi AM (Deputy Chair):** I know. I thought I would be polite here.

**Professor Frank Kelly (Professor of Environmental Health, KCL):** It was a regrettable episode, but there was an interim step and that was that David Carslaw's comment that Oxford Street had the 'highest nitrogen dioxide concentration' we were aware of anywhere in the world was translated to the 'worst air pollution' in any city in the world. That is what I think the Mayor objected to.

**Jenny Jones AM:** I do not think he knows the difference.

**Professor Frank Kelly (Professor of Environmental Health, KCL):** In reality, the statement that was made by my colleague still stands, but it was misinterpreted and misreported by the press.

**Murad Qureshi AM (Deputy Chair):** You stand by your colleague's comments. That is useful. Did you feel as a result of the incident any concern about what you write or publish?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** No, none.

**Murad Qureshi AM (Deputy Chair):** That is reassuring. There has not been any attempt to influence your statements as such in this matter?

**Professor Frank Kelly (Professor of Environmental Health, KCL):** There were discussions about whether the statements in the press were a correct interpretation of our statements. That area was clarified. As I say, we stand by the observation that currently Oxford Street has a very high nitrogen dioxide concentration. The main point is we need to do something about it.

**Mike Hawes (Chief Executive, SMMT):** We have obviously looked at the ULEZ proposals and we broadly support it. It is a balanced approach. We would make one alteration and that is the proposal that for passenger cars it is Euro 6 for diesel and Euro 4 for gasoline. We would argue it would be better on a number of levels for it to be Euro 6 for both gasoline and diesel. Certainly the emission standards are clearly aligned. Consumers do not understand about Euro standards because when they purchase a car and so forth the literature and the regulation is all about CO<sub>2</sub> and you are going to confuse matters by having a differential there.

Secondly, when this comes into play in 2020, given you would be allowing Euro 4 gasoline vehicles the same access, some of those vehicles will be 14 years old and will have a CO<sub>2</sub> emission which could be 77% inferior. You are missing an opportunity there of ensuring that you have got decent CO<sub>2</sub> performance as well as air quality performance. I know there are issues around social equality. You just do not want London to be available only to new car purchasers. Given Euro 6 is available now, some of those cars will be six years old and that is for many people two car-purchasing cycles, being the average is about three years.

The final point I would make really is an issue was raised about should we ban diesels altogether. Clearly we would argue not, given that contribution that diesel make to reducing CO<sub>2</sub> emissions. London, I know, does have a CO<sub>2</sub> objective target it wants to reach. Also reminding that down the road in Dagenham you have one of the world's finest diesel engine development centres and production facilities, which is obviously within London. It is best to support them and give encouragement for the further development of diesel vehicles which would have a benefit clearly in the economic performance of the capital as well.

**Stephen Knight AM (Chair):** Looking ahead, should any big diesel development centre be looking at alternatives given the way the wind is blowing? Perhaps they ought to be the world's biggest developer of alternatively fuelled vehicles.



**Mike Hawes (Chief Executive, SMMT):** The range of different technologies they are looking at will not be limited to diesel. However, as I said earlier in the evidence, diesel and internal combustion engines will be around for a number of years yet and give you that CO<sub>2</sub> benefit as well.

**Stephen Knight AM (Chair):** From a motor manufacturer's perspective, presumably a stricter zone that will force more people to change their vehicle would be beneficial to your members because they would be selling lots of new vehicles.

**Mike Hawes (Chief Executive, SMMT):** We are talking 2020. Some of these vehicles are on the road now. That is six years of purchasing patterns that will evolve over that time. For a system like that to work it needs to be relatively simple to communicate, and that goes back to the point I was making about getting people to make the right purchasing decisions for the type of driving they are going to do. Consumers understand the CO<sub>2</sub> standards. When you are purchasing a new car or indeed a second-hand car, there is that colour-coded label that is CO<sub>2</sub> based. They get that. It is the same if you buy a fridge as it is if you buy a car. That does not address air quality emissions. To then have to explain the difference between "You are actually buying a new car which is Euro 6 but would not be ULEZ accessible" would be a problem.

**Stephen Knight AM (Chair):** Do you think new car advertisements should have to include nitrogen dioxide and particulate emissions in the same way they have to include CO<sub>2</sub> emissions today?

**Mike Hawes (Chief Executive, SMMT):** The reason they do include the CO<sub>2</sub> is because it is about fuel economy. More recently it is --

**Stephen Knight AM (Chair):** Actually it is CO<sub>2</sub> emissions as well as fuel economy figures, is it not?

**Mike Hawes (Chief Executive, SMMT):** Yes.

**Stephen Knight AM (Chair):** They are listed separately. Presumably if car manufacturers had to put in black and white up on their advertisements --

**Mike Hawes (Chief Executive, SMMT):** There is a danger then you have an advertisement which is just littered with the fine type about the different emissions that a vehicle produces. It is absolutely appropriate that you inform the consumer and we have the balance about right at the moment. Being able to advertise a vehicle on whatever the selling point is of that vehicle, be it design, be it performance --

**Stephen Knight AM (Chair):** You would not be keen on a kind of traffic light approach. Nowadays you buy a packet of food and it has traffic lights on sugar, salt, et cetera, on the bottom of the label.

**Jenny Jones AM:** Or on white goods, you have the coloured energy-efficiency rating on the label.

**Mike Hawes (Chief Executive, SMMT):** Yes, it is a Euro standard so you would not have a differentiation. It meets Euro 6. As of September next year --

**Stephen Knight AM (Chair):** At the moment you do not see those emissions on any advertisement.

**Mike Hawes (Chief Executive, SMMT):** You have graduated emissions for CO<sub>2</sub>. As of September next year, every new car put on the market will meet Euro 6.

**Stephen Knight AM (Chair):** We know from the figures that there is a big difference between different Euro 6 vehicles. Particularly the distinction between a petrol Euro 6 - or petrol Euro 4 for that matter - and a

diesel Euro 6 is quite big in terms of nitrogen dioxide, is it not? Would it not be far better to actually have the emissions and the nitrogen dioxide and particulates there on the advertisement for all to see so that consumers could be informed? The food industry has done it. The white goods industry has done it. Why is the motor manufacturing industry not willing to do it?

**Mike Hawes (Chief Executive, SMMT):** Again, I can probably answer both of those questions at once: it goes back to the test cycle. Manufacturers will produce a vehicle which on the test cycle meets Euro 6. By September next year they are the only types of vehicles we can put on the market. It is pass or fail. Now in the real --

**Stephen Knight AM (Chair):** Pass or fail, but there is a big difference between a vehicle which just meets the Euro 6 standard and a vehicle which surpasses it by a long way. Surely manufacturers ought to be making that distinction in their advertising.

**Mike Hawes (Chief Executive, SMMT):** Again, in the real world emissions, which is what the evidence refers to, there has been that discrepancy. To go back to Jenny's [Jones AM] point and the introduction of real world emissions as part of Euro 6, there is not yet any discussion of further standards thereafter, but Euro 6 by probably 2017 will contain an element of real world emission tests within it. That will address the issue about the discrepancy. The Euro 6 standard you have at the moment is actually going to evolve over the next three years and it is not a fixed Euro 6 standard we have now.

**Nicky Gavron AM:** I just want to say, look, it is absolutely clear from this discussion that we are at some sort of tipping point in terms of awareness of exactly what is happening to adults and children in terms of health impacts of air quality. Any manufacturing trade organisation ought to be actually using that. Do you not want first mover advantage? Do you not want to actually get a move on in anticipating what is going to be a very big public consciousness of all this soon?

**Ian Bacon (Technical Manager, SMMT):** I will come back on that from a technical point of view. Until literally the last few years the equipment to reveal some of this evidence just was not available. Portable emissions equipment is a new innovation, it was not as clear as it is now. Certainly now we are aware of the issues the European Union, all the member states, are working very hard to resolve this problem. The manufacturers are supporting this. We are providing vehicles, we are providing technical knowhow. We are looking how to fix it. Remember, we are at the very edge of the science. We cannot actually measure some of this stuff to the degrees of accuracy that are being talking about. The laboratories need to move forward. We need to move forward. This is being done as fast as practically possible. That is the commitment we have given, that we are trying to bring the real driving emission standards in as soon as is practically possible. Yes, of course we are aware and we are doing all we can to resolve it.

**Mike Hawes (Chief Executive, SMMT):** If you look at CO<sub>2</sub>, as a sector we have done as much if not more than any other sector to reduce carbon emissions from our products. The recently agreed [23 October 2014] EU agreement in Brussels about delivering by 2030 40% greenhouse gas reduction; we are already there.

**Stephen Knight AM (Chair):** That is carbon emissions, which is outside our remit for this morning's discussion. Can I give the final word this morning perhaps to our two academics? Is there anything finally you would like to add given everything you have heard?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** A couple of points to respond on the previous discussion. Firstly, in terms of public information on air quality, it is something we have wrestled with for many years. I take the point that petrol and diesel all meet Euro 6 so that might not help you. However, the actual measurements over that regulatory test cycle - and leave aside for the moment how good that regulatory test cycle is - nonetheless the actual measurements in grams per kilometre are actually publicly

available on the VCA website database. There is no reason why you could not envisage a kind of traffic light system based on those numbers. They would show the difference between various vehicles, fuels, technologies and so on.

**Nicky Gavron AM:** Where are they, sorry? The traffic lights, can anyone see them?

**Professor Martin Williams (Professor of Air Quality Research, KCL):** The VCA website, yes. You could envisage developing some kind of system on that.

The other point I was going to make is the suggestion that you might have similar Euro 6 standards for both petrol and diesel in the ULEZ. The reason I thought the proposal for the ULEZ was a nice piece of evidence-based policy thinking, regardless of the fact that I mentioned earlier that I thought Euro 6 diesel could be dis-incentivised as well, is that it is the first policy instrument that has actually distinguished between petrol and diesel on an evidence basis. If you are going to have a standard that fiscally penalises Euro 5 and Euro 4 cars then you are going in contradiction to the evidence. There are good reasons why gasoline vehicles post Euro 3 are way cleaner than the previous ones. It is because the cold start problem was sorted out in the regulatory test. If you dis-incentivise Euro 5 gasoline cars, you are going to get people complaining, saying, "Why should I pay £12.50 when my Euro 5 gasoline is almost as good as Euro 6 gasoline and it is way better than those Euro 5 diesels and Euro 6 diesels?"

**Professor Frank Kelly (Professor of Environmental Health, King's College London):** The ULEZ is a great idea if we can make it more ambitious. I was very surprised when I heard that any private diesel vehicle would be allowed in at all, based on current evidence, because we are trying to comply with a nitrogen dioxide limit value which we cannot.

When we look to see how we are going to tool up and modernise our public transport system and our taxi fleets, instead of just taking bland decisions on cycle tests, which have led us down the garden path up to this point in time, we need to have real tests before we make any decisions of what is allowed in. As Martin [Williams] has already alluded to, clearly there is a vast range in emissions across even the new Euro 6 vehicles. Some of them are very good and some of them are very poor. If we just talk about Euro 6 and make decisions based on that, we are not going to get what we need.

**Stephen Knight AM (Chair):** Thank you very much. I am going to finish up this session and thank, in particular, our guests for coming along and giving up your morning to answer our questions and inform our debate.