THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

DINNER/DISCUSSION SUMMARY

How fast can the rate of change of technology be accelerated to reduce carbon emissions from transport?

Held at The Royal Society on 29th April, 2009

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Chair: **The Earl of Selborne KBE FRS**
Chairman, The Foundation for Science and Technology

Speakers[1]: **Professor Brian Collins FIET**
Chief Scientific Adviser, Department for Transport and Department for Business, Enterprise and Regulatory Reform
Professor Dan Sperling
Institute of Transportation Studies, University of California, Davis
Professor Neville Jackson
Group Technical Director, Ricardo

PROFESSOR COLLINS said that decisions on transport should not be taken in isolation; they invariably impacted on other interdependent systems such as those for water, food and energy. Social, political, economic and technical effects had to be considered and monitored. But renewable sources of energy were not likely to be sufficient to meet CO_2 reduction targets for 2050 and transport must play its part in reductions. Overall, ground based transport contributed twenty two per cent of CO_2 emissions in 2006; of which forty nine per cent came from car and motorcycle emissions and twenty three per cent from road transport. Although thirty four per cent of car travel was for short journeys, the bulk of emissions came from longer journeys mature technologies already existed to improve engine and transmission efficiency and vehicle weight and drag. Innovation was necessary for development of electric and hybrid vehicles and energy storage. The fuel market was global and innovation in fuels to lessen emissions depended on global regulation and investment criteria. Seeking behavioural change was difficult unless one had a better understanding of the impact of measures to reduce emissions on journey lengths and different socio-economic groups. His concerns were the lack of metrics which enabled accurate predictions and monitoring of effects of policies; whether we had the capability for adequate systems engineering; whether existing financial structures would support the industrial scale changes needed; and whether we knew how to incentivize people to accept the loss of transport utility, but still maintain a good quality of life.

PROFESSOR SPERLING ironically demonstrated single track strategies outlined by economists (the market), the engineer (rocket science) and the environmentalist (walk). All had points; but none would deliver the necessary CO_2 reductions if the estimated two billion cars on the road by 2050 appeared. Vehicle improvement, fuel improvement and reduced mobility demand were all essential; the first was the easiest; the second harder and the third the most difficult. But it was dangerous to rely on blanket solutions and policies for fuel or vehicles. There were, for example, good and bad biofuels, and many promising lines were still in the laboratory stage and problems could still emerge. He warned against selecting particular solutions which became fashionable -"the fuel du jour" - which ended up by not working as forecast and foreclosing or marginalizing other options. Policies should be robust, and durable, based on principle and evidence and use performance standards and market instruments. Government support might be essential to kick start emerging technologies. But support should be temporary and flexible and not oversell possible future benefits. Systems integration was important; for example the grid, household power and vehicle power could all be linked. But immediate gains could come through making vehicles more efficient. Californian experience suggested that good strategy should aim at creating model structures which others could use; stimulate innovation in technology and behaviour patterns; integrate long and short term strategies and target specific areas such as fuel efficiency. It might cost fifty billion dollars to develop fuel cells and hydrogen, but the USA was already spending ten billion dollars a year on ethanol subsidy.

PROFESSOR JACKSON said that if the 2050 targets were to be reached, all possible avenues for low carbon developments needed to be pursued - we needed to select and develop technological solutions; develop a long term vision and a road map that showed the way; and understand the particular opportunities that the UK could use to its advantage. Lighter vehicles and better batteries were good fields to develop now, while second and third generation biofuels; hydrogen fuel cells, plug in hybrids and electric vehicles were longer term. He endorsed Professor Sperling's warning against the "fuel du jour" - and said that problems were that politicians, who generally lacked a scientific or technology background and did not listen to advice, found that multi-source solutions did not yield the headlines they sought. The industry did not provide sufficient green PR and political enthusiasm often ran ahead of technical capability. Battery cost was a major problem in developing electric vehicles, but could be lessened if schemes for leasing batteries developed. But electric vehicles would only be likely to be preferable for short journeys - i.e. urban travel, which only accounted for twenty per cent of emissions. Even if by 2050 fifty per cent

[1] Professor Julia King CBE FREng, Chair of the King Report for HM Treasury on low-carbon cars, was not able to make her presentation as intended. The presentation she would have presented is on the Foundation web site – www.foundation.org.uk .

of cars were electric, targets could only be met with biofuel use and hydrogen. But it was important to analyze life cycle costs and emissions and not just look at tailgate emissions. If low carbon products were to be effective in meeting targets they need to be mass-produced. This meant ignoring niche markets, incurring large capital investment, mobilizing the mass market through design, PR and salesmanship, expanding R&D and getting the industry to work together. But there were grounds for optimism: the use of public procurement, the existing automotive skills in motor sports, and cohesive supply networks. But long term policies were essential. The UK could lead in developing clean diesel, intelligent transport systems, next generation batteries, light weight structures and design engineering.

A leading theme in the following discussion was the interaction of government policies, regulation and the market. Speakers emphasized the need for policies to be consistent, long term, technology neutral and market based. Much could be done by tighter regulation and greater focus on driver performance and speed limit. But the danger was that such regulatory activity could affect other values (such as the cost of time) and impact on particular systems. Systems engineering and much better data on the impact of policies should underlie any regulatory activity. The doubt was whether the data would be available quickly enough and our systems engineering capability sufficient to feed into regulations which needed to be made now, if 2020 and 2050 targets were to be met. But this did not mean that we should not attempt to change regulations when new conditions meant that they were outdated - an example was the taxation on diesel; another might be the refusal of the Treasury to contemplate reducing motor taxation if road pricing were adopted. It was excellent that one of the areas on which the Government had focused for research and development was the automotive industry, but it had the difficult task of supporting the area and kick starting promising technologies without attempting to pick winners.

Some speakers pressed for more regulation to be made quickly to impact on the demand side - such as behaviour, speed, shopping patterns - which some research seemed to suggest would be acceptable. California had a thirty miles per hour speed limit; why not the UK? But there were doubts about the role governments should play in altering behaviour; if people could not see that regulation or innovatory practices played to their own advantage quickly or were global in effect, and met global needs, politicians would not act. Public perception of regulation was negative; it restricted freedom without delivering compensation benefits. Low carbon use should be fostered by emphasizing benefits - e.g. free parking and priority use of motorway lanes - rather than taxing or disadvantaging high carbon drivers. Admittedly, behaviour could be changed by regulation - cigarette smoking and lead free petrol were examples, but it must be preceded by full dissemination of information to the public and full research and debate. It would only come slowly, and needed to be phased. To expect people - including politicians - to think deeply about CO_2 emissions in 2050 when they were coping with immediate economic problems was illusory. Moreover, it was important not to lose sight of the main goal which was to reduce CO_2 emissions from all sources. There was no point in regulating in such a way as to delay the decarbonisation of the electricity industry.

Questions were raised about the practicability of electric vehicles, battery development and the availability of raw materials for their manufacture. Lithium was not in the short supply feared some years ago, but there were other materials needed for electric motors, such as neodymium, which might be. The cost of the infrastructure needed to support them was uncertain. But it was clear that electric cars were not a universal solution; they would be suitable in urban areas, but not for long journeys - the major source of emissions. For these, other vehicle and fuel solutions must be developed, but for medium length journeys in suburbia, either fuel source might be practicable. RAC Foundation studies showed how reluctant people were to change from cars; which indicated that it was technical change, not behavioural change that was essential.

There was a danger that we were thinking too narrowly about regulation and markets. International standards and performance targets had to be developed, otherwise national, as well as company, competition, would impede progress. Did we know how to influence the development of international standards? However, the presence of Professor Sperling was evidence that the UK and the USA were working together to influence standard setting. There was also concern that companies had still not factored into their thinking the environmental changes that global warming would bring about, or understood the environmental issues facing us. Business schools did not include environmental issues into their curriculum, and hence graduates did not see how company behaviour could affect behavioural change or focus on adaptation to environmental challenges.

Private vehicle use was not the only transport cause of CO_2 emission - buses, trains, ships and airplanes also played a part. It was too easy to suggest that public transport could take the place of the car. But lightly loaded buses and trains were just as damaging for emissions; however this did not mean that ways should not be sought for minimizing emissions, through both design and fuel use. Aircraft only accounted for a small fraction of emissions, but failure to take action to restrain them was a significant factor in the public mind. Alas, the international politics surrounding air travel made changes in this area very difficult.

Sir Geoffrey Chipperfield KCB

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