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DEPARTMENT OF TRANSPORT
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Dear Andrew

12 APR 1989

CLIMATE CHANGE (file with AT)

I attach a note by the Secretary of State for Transport for the Prime Minister's meeting on 19 April, as requested at the Prime Minister's meeting in January.

I am copying this letter to Andy Bearpark at No 10, Richard Gozny (Foreign & Commonwealth office), Kate Bush (Environment), Ben Slocock (Trade and Industry), Peter Swift (Education & Science), Debbie Haine (Agriculture), David Murphy (Energy), Richard Calvert (Overseas Development), and Rosie Chadwick (Paymaster General).

Yours sincerely

K. Orrell

KATHERINE ORRELL
Private Secretary

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OPTIONS FOR REDUCING GREENHOUSE GASES FROM VEHICLES

NOTE BY THE SECRETARY OF STATE FOR TRANSPORT

The Baseline Position

1. Transport (mostly road transport) accounts for about one fifth of all CO_2 emissions in the UK. CO_2 is an inevitable consequence of combustion of petroleum-based fuels.

2. There have been two main past trends affecting growth in CO_2 emissions from transport, both of which are set to continue if nothing is done. The first is a substantial improvement in fuel efficiency per vehicle. Over the last 10 years average fuel consumption in cars has improved by about 20%. This favourable trend is expected broadly to continue.

3. Second, however, there has been a substantial increase in traffic, which is also expected to continue. The national traffic forecasts for Great Britain suggest increases of between 23% and 47% in vehicle kilometres from 1986 to 2010.

4. The increase in traffic has thus more than offset the benefits from greater fuel efficiency. Between 1977 and 1987 road transport consumption of petrol increased in the UK by approximately 28% and of derv by nearly 50%.

5. These trends are in line with those in other countries. They show that it is likely to be extremely difficult even to prevent a continuing increase in CO_2 emissions from transport, let alone secure a reduction.

Technical Improvements - Current Position on Emission Regulations

6. In theory major reductions in CO_2 emissions could be achieved through a shift in fuel for vehicles away from petroleum fuels to other kinds. But none of the possibilities - hydrogen, methanol, compressed natural gas or electricity - look at all plausible as alternatives for the foreseeable future.

7. A much less radical alternative is the use of lean-burn technology. This is described in the annex to this paper. It can achieve potential fuel economy benefits of around 10% compared with the alternatives - which is useful, but clearly still modest when set against expected traffic growth. On the basis of the traffic forecasts given above it would merely somewhat reduce the level of increase, but nowhere near halt it. In effect it would merely be postponing reaching a given level of CO_2 emissions by just a few years.

8. There is a trade-off between the use of lean burn engines to reduce CO_2 emissions and the need to reduce other emissions (carbon monoxide (CO), hydrocarbons (HC) and oxides of nitrogen (NOx)). This is because lean-burn engines cannot easily be combined with vehicle designs aimed at meeting emission standards designed to curb these other vehicle emissions, notably NOx. Under existing EC emission standards this virtually rules out their use for cars in the EC over 2 litres on available technology ; in most of the rest of the developed western world, with tighter emission standards, notably in the US and Japan, it effectively rules lean-burn out altogether.

9. We can nevertheless try to gain some international credit by encouraging international agreement on the use of lean-burn engines - even though the chances of success are probably slim, because of the counter-effect on other emissions. We can point to the trade-off between fuel efficiency (and thus CO_2 emissions) and the control of the other emissions. Several countries, including some EC member states, are giving thought to tighter limits on CO, HC and NOx; but we now have an environmental as well as an economic reason to restrain enthusiasm in this direction. We should encourage those countries committed to the universal use of 3-way catalysts to reconsider their position.

10. In doing so, we can point out to our European Community partners that the standards we have agreed for the 1990s (at least before the Commission's latest proposals - see below) within the EC mean that for the majority of cars we have held back from the tightest standards, favouring instead technically advanced, cheaper and more fuel efficient technologies, such as lean-burn. To safeguard these technologies, we can say, interest should be increased in fuel economy in the market place, so that manufacturers are encouraged to exercise the freedom, which has been hard fought, to develop and use these technologies.

11. It is doubtful, however, if this will gain us a very ready response. In particular it is virtually impossible to conceive that those countries which have already adopted 3-way catalysts standards for the full range of cars (US, Canada, Australia, Japan and EFTA members) would be prepared to relax their standards to accommodate lean-burn. Moreover the trade off between different kinds of emissions does not really work in our favour. From going from lean-burn to 3-way catalysts, CO_2 emissions are increased by 10% but NOx emissions are decreased by at least 25%: so these countries might reasonably argue that the increase in CO_2 emissions is a price worth paying. Finally the most recent position of the Commission (in anticipation of the views of the European Parliament) - seeking to provide still tougher and earlier standards on emissions other than CO_2 than those only recently agreed by member states - is likely to reduce further the scope for lean-burn, though the Commission's position has yet to be clarified or accepted by the Council of Ministers.

More Radical Measures - Restraint on Vehicle Usage

12. This suggests that the only way of making any significant impact on CO_2 emissions would be measures to restrain vehicle usage. It would of course be essential that they were accompanied by comparable action by a large number of other countries. Theoretical possibilities include:-

a) Large increases in fuel prices through an active fiscal policy (not offset by a reduction in vehicle excise duty, since the aim would be to reduce vehicle usage, not to achieve fiscal neutrality);

b) Severe restrictions on access, through traffic bans or road pricing;

c) Very substantial additional investment in public transport capacity.

13. The main difficulty is that the scale of any such measures would have to be very large to have an appreciable impact on the problem. Such an impact requires not just a halt to the forecast increases in fuel usage but rather a reduction in usage.

14. There is much uncertainty over the effects on vehicle usage of fuel price increases. One recent study suggests a long term elasticity of just under -1, ie for ever 1% increase in fuel prices there would be nearly a 1% reduction in mileage (though only after a time lag allowing for changes in vehicle design, user behaviour etc). Other work, however, suggests the effects on mileage would be less pronounced. But even taking the -1 elasticity, on the basis of the traffic forecasts on para 3 above, this still means petrol prices would have to rise by at least a quarter in real terms, every ten years or so merely to halt the the increase in mileage. To secure a reduction in mileage - or merely to halt the increase if the -1 estimate of price elasticity is indeed too high - bigger rises would be needed. In other words to achieve a significant effect on emissions very large price increases would be needed, on a scale much bigger than that which we have recently seen. These would have severe effects on mobility and on the economy in general.

15. Similar problems arise on the other possibilities. On road pricing the Department is already arranging further experiments as recently agreed by Ministers (E(A)(89) 3rd meeting). But it is far too soon to suggest that road pricing can make a significant contribution to reducing vehicle mileage - if indeed it ever can. It has in any case other goals to achieve, including the encouragement of private finance and of new infrastructure. It is equally doubtful if major investment in public transport can

significantly reduce vehicle usage except on a far greater scale even than that which we are already contemplating; that would of course have major public expenditure implications.

16. There is a more general difficulty with all these proposals. This is that they cut across other transport and economic objectives, which are designed to encourage mobility and rely on market forces. It would be difficult to explain publicly why the need to minimise the greenhouse effect should be singled out as an overriding objective to set against these other transport aims.

17. By contrast we could more easily present a policy of attempting at the margin and over the long term to take some account of the greenhouse effect when using such policy instruments as are easily available to us. For example we could quote the greenhouse effect as a justification for tending over time to favour taxation increases on fuel rather than on vehicle ownership as having a more direct benefit to the greenhouse effect. But it would be idle to pretend that such measures, even if internationally adopted, would have any significant effect on the problem unless they were out of all proportion to their scale in the past.

Conclusions

18. There do not seem any easy solutions in the transport area. Any action would need to be on an internationally agreed basis. But only very radical measures, on a scale we have never contemplated up to now, are likely to have any significant effect on the problem. The adverse consequences, on the economy and on mobility, would be severe.

19. We can encourage more modest measures, such as the development of regulation so as to encourage lean-burn technology, and discourage new standards which further restrict its use. We could also move towards gentler increases in fuel taxation. We can gain some useful international credit by stressing the benefits of these. But it will be very hard to obtain international agreement on under use of lean-burn technology; and the effects of both kinds of measure on the greenhouse problem will be relatively insignificant.

DEPARTMENT OF TRANSPORT
April 1989

ANNEX

THE LEAN-BURN ENGINE

What is lean-burn?

Conventional petrol engines are tuned so that the air and fuel mixed in the intake are correctly balanced for complete combustion. Too much petrol (a rich mixture) would mean that some petrol would pass unburnt and wasted through to the exhaust. Too little petrol (a lean mixture) would result in the engine not being able to run smoothly, with misfires and possible stalling.

For many years engineers have been aware that the fundamental thermodynamics of engine theory mean that fuel economy benefits of around 10% could be obtained if the misfiring and stalling problems associated with lean running could be solved.

"Lean-burn" is the generic term for technologies that have overcome these problems.

Emissions from lean-burn engines.

Lean-burn engines (without catalysts) emit less carbon monoxide and oxides of nitrogen than the modern generation of non-catalyst, conventional engines. It is possible that their hydrocarbon emissions are slightly higher.

Lean-burn engines with oxidation catalysts have similar emissions of carbon monoxide and hydrocarbons to three-way catalyst equipped engines. Unfortunately it is not possible on available technology to use a catalyst to reduce emissions of oxides of nitrogen from lean-burn engines as they emit greater quantities of these gases than do three-way catalyst equipped engines (though smaller quantities than conventional engines).

The effect of the new EC emission limits

All effort to develop lean-burn engines over two litres has now ceased, because the three-way catalysts needed to meet the limits for these engines are incompatible with lean-burn. Lean-burn engines below two litres should still be able to meet the more relaxed limits applicable to that category (including the EC stage II for small cars), provided oxidation catalysts are fitted. However the Commission's most recent views - that tougher standards than Stage II should be implemented by the beginning of 1993 - would probably not be compatible with lean-burn technology.

Industrial interests

The interests are mostly UK based. Ford Europa and Rover are the two manufacturers (worldwide) who are still actively promoting lean-burn. It is thought that Fiat and Peugeot-Citroen are also developing the technology, but Volkswagen, BMW, Daimler-Benz and General Motors are committed to the three-way catalyst route. The position of Renault is uncertain.

Environmental affairs :- Acid Rain Pt 9.