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The Challenge of Climate Change

Conclusions and Key Findings

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Workshop 1 Advances in energy-efficient transport technologies

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MAIN FINDINGS

Potential and timescales for technology-based fuel economy improvement

- 30% fuel economy improvement is obtainable through advances in conventional or mainstream automotive technologies. Improvements of 50% and above over are likely to require hybridization. Longer term, going beyond 50% is a real possibility through electric vehicles and/or fuel cells.
- Critically, if we are to deliver significant reductions in CO₂ emissions we need to ensure all of the technological potential is used to improve fuel economy, not to increase performance. In this situation, achieving 30% improvement in new cars within a decade is realistic.
- Although policy should be designed to support the development of technology for the long term without picking winners, there is a fairly widespread view that electric vehicles will outperform fuel cell technology in terms of reduced cost/complexity and total CO₂ emissions because of the additional losses incurred by using H₂ as an energy vector.
- The development of high power density, sustainable battery technologies is a key research priority and requires funding not only by industry but also by government.
- Driving behaviour has a significant effect on fuel consumption. Introducing technology to run cars in standard 'eco driving' settings could have considerable payoffs. The technology should be implemented in such a way that drivers are "locked into" the most efficient driving mode, and moving out of it requires action.

Technology costs

- The costs of introducing mainstream technology, to improve fuel economy by some 30%, range from zero to small in the sense that any increase in the purchase price is compensated by savings on fuel within two to three years. One example quoted was a seven speed double clutch transmission which improved fuel economy by about 7% compared to a standard manual box, at no additional cost.
- Since history shows that such 'no-regret' options are not necessarily taken up by consumers – indeed that consumers typically apply 'implicit discount rates' of 40 -60% to future savings – there is a justification for policy intervention to deliver significant CO₂ savings in a short timescale.
- The current costs of improving fuel economy by 50% are higher. An example quoted was a lithium-ion battery powered electric car with a

driving range of around 100 km, estimated to cost about \$5000 more than an equivalent conventional vehicle. Including costs for more complex hybrid propulsion systems could inflate the additional cost to some \$7000, or roughly 20% to 30% more than a conventional car. Historical data suggest that motor industry cost reduction, post regulation and with a mass market, is typically in excess of 50%.

- While there is no single vision of what future automotive technology will look like, it was felt that low carbon alternatives are not excessively costly, on condition that electricity or hydrogen can be produced with low CO₂-emissions.
- The introduction of vehicles that are significantly more expensive to buy but cheaper to use could be accelerated through new business models. For example, spreading the cost of batteries over the lifetime of the vehicle through leasing arrangements could speed up market penetration of hybrid and electric vehicles.

Test cycles better calibrated to real world driving

- The differences between standard test cycles used to rank vehicles and real on-road driving performance, especially in congested conditions, need to be minimized. 'Design-to-the-test' will occur, potentially inhibiting the introduction of some beneficial technologies and jeopardizing the effectiveness of fuel-economy standards. Ongoing work in this area, e.g. by UNECE, should be supported, and widely discussed to ensure that optimum standards are developed and accepted internationally.

The Fuel Economy Standard is a key policy instrument

- Whether all technological potential will be used to improve fuel economy is dependent on policy, because in an unregulated market at least part of the potential is likely to be used to enhance performance, as has happened historically. A fuel economy standard is a key component of a policy package that stimulates the use of technology to improve fuel economy.
- The car industry generally welcomes a fuel economy standard approach as it reduces uncertainty, and many companies believe it produces a level playing field.
- In the interest of driving further technological development in a rational way across all fuel types, the standard should be expressed in units of kWh/km, not just litres/km, as the latter only applies to liquid fuels. The difficulty here, however, is that the carbon-intensity of electricity production differs markedly among countries. For example, in Sweden using a particular electric vehicle would result in emissions of 6g/km, 12g/km in France, 72g/km in Germany, whereas for Greece it would be 120g/km (Oliva, 2008).

The pressing need for ‘clean and green’ electricity

- Going beyond 50% fuel economy improvement, the benefits of new automotive technology are strongly dependent on the emissions levels associated with the electricity supply. Since the costs and timescales for new technologies and power generation plants are many times those in the automotive industry, this must be a priority for governments.

Preventing an increasingly carbon-intensive energy supply

- In contrast to the vision of ‘clean and green’, there are concerns that transport fuels are being produced in a more carbon-intensive way as oil prices rise (e.g. using non-conventional sources of oil, such as oil sands, to supply 10% of the market increases CO₂ emissions by 1.2%; Heywood, 2008). Avoiding this evolution requires policies covering all fuel types – not just biofuels - which are based on the carbon content of the fuel.

Taxation

- As the UK experience with the company car tax shows, differentiation of tax breaks according to CO₂ emissions can strongly affect company car choices, an important market segment in many countries. Differentiation of annual ‘circulation’ taxes is effective in modifying the choice of vehicle type as well. These are useful policy instruments, which can deliver quick results in a sector where carbon taxes are unlikely to be implemented fast.
- Clear policy targets for deep emission reductions would justify a high carbon price. This might mean that prevailing excise duties on auto-fuels in Europe (200 – 300€ per ton of CO₂) should apply as a carbon tax to all fuels. Such a radical change would pose a tough political challenge.

Developing economies

- The debate very much focussed on OECD countries, but it was pointed out that managing emissions in the fast growing, emerging economies is of critical importance with their low but rapidly growing levels of car ownership – less than 1 vehicle per 100 people in India and China today, compared to levels around 50 per 100 in the US and Europe. While OECD countries may take the lead, technology collaboration with emerging economies is highly desirable. There is a role for public funding to support such collaborative efforts.