



The Royal Academy
of Engineering

RESPONSE TO DEFRA

REVIEW OF THE UK CLIMATE CHANGE PROGRAMME

**Memorandum submitted by
The Royal Academy of Engineering**

March 2005

Q2. How well are existing measures to reduce emissions working? How might these be improved? Should any of these measures be dropped?

- 2.1 Existing Government measures to reduce emissions have not been as successful as predicted. This is evidenced by a recent announcement that the target of a 20 per cent reduction in CO₂ emissions from 1990 levels is unlikely to be achieved and that a reduction of 14 per cent is more likely¹.
- 2.2 Much of the progress to date on emissions reduction has not been a result of Government measures but rather the shift from coal to gas fired combined cycle power stations. Other factors which have also contributed to reductions have been the decline in the UK manufacturing base and the adoption of energy saving technology in industry.
- 2.3 As a result the UK is currently in a position where many of the 'easy fixes' for reducing emissions have already been adopted and much more concerted effort will be needed to reduce emission levels further. In terms of power generation, a worrying trend is the volatility of gas prices which is currently causing a resurgence in coal fired generation as coal prices are much more stable. Clearly, this has implications for increased carbon emissions and the priority must be to develop a diverse mix of energy supply which includes fossil fuels, alternative energy sources and nuclear power.
- 2.4 Clearer policy on the future of nuclear energy in particular is needed as the Energy White Paper provides for no replacement of the existing nuclear power stations set to be retired over the next fifteen years. Past emissions reductions will therefore likely be lost unless measures are developed to replace this capacity. Furthermore, it is difficult to see how the Government intends to achieve its future emission reduction targets without some form of nuclear new-build as renewable technologies alone are currently incapable of delivering the level of power generation needed.
- 2.5 Given the timeframe for the construction of a new nuclear power plant, decisions on the industry's future need to be made as soon as possible if any progress towards current targets is to be made. The challenge for Government is to develop an energy supply programme that looks to 2020 and beyond and avoids the temptation to focus exclusively on short-term changes that are less effective in producing the sustainable emissions reductions required for the long term.
- 2.6 In terms of improving other existing measures, reducing the demand for energy needs to be made a priority in tandem with addressing energy supply issues. To date progress in this area has been slow and there is pressing need for concerted government action to fully inform the public on the consequences of inadequate action over the next ten to fifteen years.

¹ DTI Updated Emissions Projections - 11 November 2004
<http://www.dti.gov.uk/energy/sepn/uep2004.pdf>

- 2.7 The Climate Change Agreements (CCA), intended to bring about emissions reduction in the energy intensive industries without harming their international competitiveness, have been successful but their limited scope has excluded a major part of the manufacturing industry. Currently only those companies covered by Integrated Pollution Prevention and Control (IPPC) regulations are eligible for the CCA which has meant that those not covered under these regulations have been disproportionately effected by the Climate Change Levy. Participation in CCA should not be limited to those covered under IPPC and the application process should be simplified to encourage the greatest take up.
- 2.8 The Climate Change Levy appears not to have had as significant an impact as was envisaged and with the introduction of emissions trading it is difficult to see how the two measures can co-exist. If the Climate Change Levy were to be abandoned and replaced with emissions trading, the total emissions cap would need to be set at a sufficient level so that traded prices will be high enough to have an effect.
- 2.9 The use of measures such as emissions trading schemes should be supported and the UK Emissions Trading Scheme for example has been found to be very helpful in stimulating energy reduction initiatives. Whilst initiatives such as the forthcoming EU Emissions Trading Scheme are to be supported, care must be taken to ensure that the UK's competitive position in world markets is not adversely affected.
- 2.10 The European Directive on Combined Heat and Power (CHP) was issued in February 2004 but remains virtually unknown in the UK. With a significant amount of new construction planned for the south east of England there is an opportunity to reduce emissions by ensuring that CHP technology is used extensively. Furthermore, at the national level considerable amounts of energy for power and heating purposes could be generated from waste incineration. Greater effort needs to be made to overcome the current barriers to more widespread application of this technology.
- 2.11 The EU Non-Road Mobile Machinery Diesel Engine Exhaust Emissions Directive covers all types of diesel engines used by railways. The directive requires that when replacement engines are fitted, or when an existing engine is modified such that its exhaust emissions may be changed, then compliance with current emissions limits must be achieved. Rail vehicles have major constraints on availability of space and in many cases retrofitting a fully compliant engine is impractical. The directive as currently drafted encourages the retention of old polluting engines rather than progressive emissions reductions to a level that, although not fully compliant, would be a great deal better than retaining the original engine. Consideration needs to be given to redrafting this directive to permit an incremental approach to engine modification.

Q7. What new measures for reducing carbon dioxide emissions might be considered?

- 7.1 As highlighted in question two, if the Government is serious about achieving its reduction targets for carbon dioxide emissions then a clearer policy on nuclear energy is needed. Investment in new facilities now will ensure the UK has a secure supply of energy to meet its needs and that carbon reduction targets will be met in the near future. The investment of resources to further improve the safety and costs of nuclear fission processes should be considered as should investment in research into other clean generation technologies which will replace nuclear fission in the longer term.
- 7.2 In terms of renewable energy, the Government needs to ensure a balanced investment in the development of a range of technologies. Currently the Government appears to be focused on wind power, almost to the exclusion of other renewable energy sources. A good example is the lack of progress on the development of biomass as a energy source despite in-depth reports from both the Royal Commission on Environmental Pollution² and the House of Lords Science and Technology Committee³ identifying key measures to develop the sector. The Government's response so far to these reports has not been well received.
- 7.3 One key area the Government needs to devote greater resources to is research and development into effective carbon sequestration techniques. Carbon sequestration has significant potential to reduce carbon emissions much more economically than other measures. In particular, improved techniques are needed for carbon dioxide separation, capture and storage. In terms of separation, sequestration is likely to be particularly attractive in connection with producing hydrogen from hydrocarbons as this process produces an essentially pure carbon dioxide stream.
- 7.4 Another point which is continually overlooked is that heat is a form of energy and represents a large component of UK energy use. Heat demand in the UK is anomalously high due, to a large degree, to the lack of effective insulation in the existing building stock. There are several opportunities to improve this situation such as promoting the use of combined heat and power technology as well as learning from the experience of countries like Germany and Sweden on retrofitting existing buildings. However, there are skills shortages in the UK in both construction workers and inspectors who can ensure that building regulations are met. Another suggestion is to develop renewable heat credits, reflecting schemes like Renewable Obligation Certificates for electricity, to stimulate the development of a renewable heat sector.

² <http://www.rcep.org.uk/bioreport.htm>

³ <http://www.publications.parliament.uk/pa/ld200304/ldselect/ldsctech/126/12602.htm>

7.5 Given the international nature of the carbon emissions problem, international solutions are essential otherwise competitive distortions will arise such as production being transferred to countries with the least controls on emissions. For the UK, greater participation in Europe-wide initiatives will be the likely first step to be pursued. Tariffs on imported goods which do not follow similar standards to those goods produced in the UK is just one example of measures which could be advanced at this level.

Q9. On what basis should new measures be decided? How should we assess the practicality, cost-effectiveness and distributional implications of possible measures to ensure a balanced and equitable programme?

- 9.1 Current methods of applying cost benefit analysis are sufficient and are able to ensure the adoption of measures which are environmentally beneficial, technically feasible and economically viable. An objective assessment of the likely costs to Government of implementing a variety of different measures should be undertaken. Similarly, an objective assessment of the carbon dioxide benefits and any other national and social benefits (such as security of supply and balance of payments) should also be undertaken. Measures and support should focus on those areas where the greatest overall benefit can be achieved at best value to the taxpayer.
- 9.2 In terms of distributional implications, energy pricing is a key area that will require close attention. If energy prices increase in an attempt to reduce demand this is likely to have a disproportional impact on low income households and energy intensive industry sectors. There are a number of alternative measures that could be pursued to reduce demand rather than increasing pricing⁴. However, if an increased pricing strategy were to be adopted then fuel poverty would need to be decoupled from the energy issue and treated separately as a poverty issue, otherwise it will be used as a justification for keeping energy prices artificially low.
- 9.3 With regard to ensuring a balanced and equitable programme, a straight forward carbon tax, based on the carbon dioxide emitted rather than energy consumed, is one measure which should be re-examined. Such a tax could be readily calculated and collected in the same way as excise duty. The rate of tax would have to take account of many environmental and economic factors which would remain a Government decision but could be made politically acceptable by balancing reductions in other taxes.

⁴ See Question 24 below.

Q24. What scope is there for introducing or strengthening existing regulatory, planning or market-based instruments to achieve a higher proportion of the potential carbon savings in non-energy intensive business sectors, such as by reducing electricity use in the commercial sector?

- 24.1 Commercial pressures have had a moderate impact in encouraging the adoption of energy reduction technology. However, low energy costs compared with other fixed costs in non-energy intensive businesses (such as office based industries) has meant that for many, reducing energy use any further is not seen as a priority. Whilst increasing energy costs is a measure that is likely to have some impact it will disproportionately impact both on energy intensive businesses and low income households. There are a number of alternative incentives that could be considered by Government to encourage business to reduce energy use.
- 24.2 In terms of regulation, one measure that could be pursued is to extend the Climate Change Agreements to cover all businesses, not just energy intensive ones. This will encourage those that can make cost effective energy reductions to make them without increasing their tax burden and unduly penalising them. However, the existing process would need to be simplified in order to make it easier for the sector to understand.
- 24.3 The planning system also offers several opportunities to promote energy reduction through for instance making the installation of energy reduction technology a condition of planning consent. A mandatory CO₂ cap could also be built-in as a requirement of any new building schemes and the planning process could encourage the use of appropriate and cost-effective energy reduction technologies.
- 24.4 Various market based instruments could also be introduced to reduce energy demand. Possible new measures could include incentives to reduce the use of electricity for heating purposes. For every kilowatt used for heating, roughly 1.5 kilowatts are wasted in the generating station and transmission network. Although electrical heating, particularly if used off-peak, is attractive economically for the supply industry, there is a substantial generation of carbon dioxide which could be avoided if other forms of heating such as combined heat and power were used. The use of biomass as a fuel for space and water heating in new commercial developments could also be incentivised, serving as a further measure to promote a market for renewable heat as highlighted in section 7.4.
- 24.5 Whilst education programmes and market incentives to improve the adoption of energy efficient measures in business should be encouraged, it is important to note that energy efficiency measures generally take a long time to demonstrate real benefits. They are most effective when new technology is introduced, rather than by retro-fitting improvements to existing facilities. Such measures should not be expected to deliver rapid improvements, and often will do no more than slow the overall demand growth rate.

24.6 It is also worth noting that whilst measures to reduce energy demand should be supported, significant amounts of carbon-free energy can be made available from nuclear power. As was highlighted in question nine, the Government should carry out a rigorous cost benefit analysis to ensure it is not penalising industry and taxpayers unduly by pursuing inappropriate, expensive and unnecessary measures.

Q30. What new measures might we consider at the EU, national, regional or local level to develop cleaner, greener transport and reduce reliance on fossil fuels?

There are several measures Government could consider to reduce reliance on fossil fuels in the transport sector:

EU Level

- 30.1 Government could encourage the extension of the European emissions trading scheme to cover transport emissions (including road, rail, water and air) from the commencement of the second phase in 2008. However, it may prove challenging to apply the scheme to road transport in particular within this time scale. Any extension would have to be defined in such a way as to avoid unduly penalising European industry with respect to its international competitors.
- 30.2 However, given the concerns over the impacts of air travel on climate, especially short-haul flights, bringing air travel into emissions trading may not be sufficient and further measures may be needed to manage the impacts of both passenger and freight air transport. An integrated system of air and electrified railway transport would be of major benefit in reducing emissions but is unlikely to be implemented in the short term. If developed, high-speed connecting rail routes from the UK could eventually provide services to replace the need for short haul flights. A "hub" layout for airports would permit the use of large aircraft which would cause less emissions per mile. This should be seen as much an EU as a UK priority.
- 30.3 Much is being done to address the current impact of the aviation industry at the EU level. The European aviation industry, in the form of the Advisory Council for Aeronautics Research in Europe (ACARE) has set out the strategic research agenda for delivering reductions in the aviation industry's use of fossil fuels. Government should support the work of ACARE, in particular the development and implementation of new technologies, as without support the industry is unlikely to implement such changes itself.
- 30.4 The EC executive has made a number of statements indicating that hydrogen technology could eventually be a viable replacement for fossil fuels. Whilst research and development in this area should be supported, hydrogen must be produced in a way which does not itself produce emissions, if the adoption of such technology is to bring genuine emission savings. Nuclear energy is the only proven realistic means of delivering the large-scale low-carbon electricity that can be used to generate hydrogen. In addition, new high temperature nuclear reactor concepts offer the potential to generate hydrogen directly and more efficiently from the high temperature process heat.

National Level

- 30.5 Encouraging a modal shift to rail and investing in a number of key improvements to the current system would have a significant impact on reducing UK carbon emissions. With high load factors, rail is currently one of the most efficient transportation options in terms of emissions per passenger or tonne of freight per kilometre. The adoption of electric traction for railways offers the potential to reduce carbon dioxide emissions even further by taking advantage of the expansion of power generation from non-fossil fuel sources. In addition, considerable reductions in emissions could be achieved by the widespread use of regenerative braking which allows power to be returned to the electrical distribution system during braking thereby reducing the overall power generation requirement.
- 30.6 The UK has missed a generation of high-speed rail development that has seen the introduction of 300 kph trains throughout Western Europe. The introduction of new high speed technology in other countries points to a means of replacing short domestic flights and long distance road journeys with a much quicker and more environmentally friendly method of long distance travel in the UK. The possibility of moving to a core ultra high speed network for the UK should be examined in detail.
- 30.7 The use of diesel hybrid engines in rail and road transport has the potential to offer significant economies in the use of fossil fuels in the near term. For non-electric railways, power systems could be introduced that utilise smaller and lower emission, diesel engines in combination with latest battery technology. As acceleration uses both diesel and battery power the train is able to maintain speed using diesel alone and re-charge the batteries by using regenerative braking. This technology has the added benefit of reducing the length of time diesel engines need to be left idling. Longer term, rail vehicles could also provide an appropriate platform for hydrogen fuel cell technology.
- 30.8 In terms of road transport, the wide scale adoption of hybrid vehicles has been slow given the high capital cost of production. Whilst some people may be willing to pay a premium for an environmentally friendly vehicle, Government could offset the cost via legislation to encourage wider uptake. In the short term the Government should pursue a phased policy where vehicles with high petrol consumption are replaced with diesel or LPG engines, then with hybrids and then phased out all together. All these processes will have to be driven by legislation and not be controlled simply by implementing a fuel tax.
- 30.9 If Government is serious about reducing the emissions impact of road transport than it should use the vehicle licensing system to impose a minimum fuel economy level or maximum engine size on new vehicles and increase licence duty on existing vehicles that exceed the limit, such as 4X4 vehicles, that are not needed for commercial purposes. In the short term, greater efforts to reduce congestion by improving traffic flow through measures such as better road design and traffic modelling could have a significant impact on reducing emissions.

Regional Level / Local Level

- 30.10 In terms of local public transportation, the Government's priority should be firstly to support the development of a functional, safe and reliable public transportation system in many areas. The lack of such transport systems in many towns and cities has fueled increases in personal car ownership with concomitant rises in carbon emission levels. Developing public transport powered by alternative low carbon fuels should also be pursued and there are many demonstrator projects across the UK that can provide evidence of the viability of the relative technologies.
- 30.11 More support is also needed for organisations encouraging the use of non-polluting forms of transportation amongst the public. The work of organisations such as Sustrans who are active promoting cycling and walking and developing safe routes for such users are a good example.

Q31. What should be the role of industry and other stakeholders in developing and implementing low carbon vehicle and fuel technologies?

- 31.1 Industry can identify and develop new technologies, but they will only be able to make a contribution if there is a public acceptance and demand for change. It is likely that public awareness programmes and financial incentives will be required if technology is to play its full part in tackling climate change. There is a clear role for Government to help educate the public and encourage the adoption of low-emission technologies through targeted measures, for example by making hybrid vehicles exempt from VAT.
- 31.2 Clear long-term government policies and support for research and development is required to create the necessary environment for industry to invest and develop new products. There is also a role for Government to work with industry to develop demonstrator projects in low carbon vehicle and fuel technologies. Industry is characteristically risk averse and companies are unlikely to adopt unproven technology unless the commercial potential is made evident.
- 31.3 The development of commercial low carbon vehicle and fuel technologies is also dependent on a steady supply of skilled engineers and scientists. One priority must therefore be for Government to promote Science, Engineering and Technology subjects in order to counter the current lack of graduates in this area.
- 31.4 In terms of the UK railway industry, as mentioned in section 2.11 current legislation is discouraging the retrofit of low carbon technologies. Unlike the road sector, there are no grants or sources of funding available to the railway industry to support emissions reduction. Government should assess the overall value of reducing emissions from existing rail vehicles in comparison with reductions in other sources of emissions. If reducing rail emissions is seen as justified, instigating a grants scheme to incentivise industry will be needed as well as changes to the legislation to encourage retrofitting of appropriate technology.

Submitted by:

Mr P Greenish CBE
Chief Executive
The Royal Academy of Engineering
29 Great St Peter St
Westminster
London
SW1P 3LW
Tel: 020 7227 0501

Prepared by:

Nicholas Wilson
02/03/05