

**April 2005**

## Royal Society response to Defra review of the UK Climate Change Programme

This response has been approved on behalf of the Council of the Royal Society by the Treasurer and Vice-President Sir David Wallace CBE FRS. It was prepared in consultation with the Society's Energy Policy Advisory Group (EPAG) and other experts in the field.

### Summary

- Sufficient scientific evidence exists to support urgent and deep reductions in national and global anthropogenic greenhouse gas emissions.
- By the Government's own admission, its policies are not sufficient to meet the targets set out in the UK Climate Change Programme. We consider that under current policies, even the revised target for reduction in carbon dioxide (CO<sub>2</sub>) emissions outlined in the Review consultation is very ambitious.
- Government policies should be directed towards ensuring that there is a penalty on all emissions of CO<sub>2</sub>, irrespective of the nature of the source. We consider the introduction of well-designed economic instruments, such as a carbon tax or auctioned permits, is the most cost-efficient way to reduce greenhouse gas emissions.
- We believe the current climate change levy is an inefficient economic instrument as it targets energy use rather than carbon dioxide emissions. The levy penalises nuclear power and other non-emitting sources, which are effectively carbon free.
- The free allocation of the majority of emissions within the EU emissions trading scheme weakens its impact as a tool to generate emission reduction. We consider that whilst the grandfathering allocation method is an adequate mechanism to initiate an emission trading scheme, in subsequent allocation periods emission permits should be auctioned.
- A key challenge for science is to provide an increasingly sophisticated probabilistic framework of impacts that can be used in a societal risk assessment. Funding and developing improved high resolution global models will aid our understanding of the earth system and enable the development of appropriate responses to the impacts of climate change.

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

By the Government's own admission, its policies are currently not sufficient to meet its target of 20% CO<sub>2</sub> emission reduction, from the baseline of 1990 levels, by 2010. The Review consultation (DEFRA 2004) outlines that the impact of current policies and measures will reduce CO<sub>2</sub> emissions by 14%, by 2010, as opposed to the 19% estimated in the UK Climate Change Programme (DETR 2000). Between 1990 and 2003

CO<sub>2</sub> emissions have decreased by 7% and in the next five years the Government plans an extra 7% reduction in emissions.

As the Review consultation highlights, a proportion of the UK CO<sub>2</sub> reductions to date have come from changes in the type of fuel for electricity generation or from reduced output in the industrial sectors, independent of Government climate change policies. Given this and the fact that in 2002-2003 UK CO<sub>2</sub> emissions increased by 1.5% (DTI 2004), we consider that even the new projected 7% reduction in CO<sub>2</sub> emissions is very ambitious.

#### *Economic instruments*

Government policies should be directed towards ensuring that there is a penalty on the emitter for all emissions of CO<sub>2</sub> irrespective of the nature of the source. This should be applied across all sectors; industrial, domestic and transport including aviation. The introduction of well-designed economic instruments, such as a carbon tax or auctioned permits, is the most cost-efficient way to reduce greenhouse gas emissions<sup>1</sup> (Royal Society 2002).

A carbon tax will reduce the energy content of energy services by raising the overall price of energy. The higher price of energy encourages substitution away from energy use towards alternative ways of providing the services associated with energy. By placing an increasing price on carbon, the tax will also encourage the production of cleaner technologies and the substitution away from carbon-based fuels in the overall energy supply. For example a carbon tax would make coal less attractive than gas and both fuels less attractive than renewables and nuclear energy. Our report (Royal Society 2002) also highlights that a carbon tax can reduce the demand for energy services and rebalance possible increases in energy use as a result of energy savings.

Introduced at an initially low level, the tax would gradually increase giving businesses time to adjust. Analysis in the Royal Society report (Royal Society 2002) has shown that the impact of a carbon tax on long-term global GDP for drastic reductions in CO<sub>2</sub> emissions would be small, with estimates in the region of 1%. The success and benefits of economic instruments are greatly improved as their introduction is extended to Europe and beyond. We recognise that a carbon tax would make energy more expensive possibly contradicting one of the Government objectives to ensure affordable heating. However we consider that vulnerable members of society should be compensated, not shielded from a tax through existing or new measures.

Although market mechanisms should have a principal role in driving CO<sub>2</sub> reductions, implementing the correct regulation and Government funding are also important. Throughout the submission we highlight some areas where these additional measures can be applied.

#### *Climate change levy*

A major component of the UK Government climate change programme is the climate change levy. We consider this a limited economic instrument for the reduction of CO<sub>2</sub> emissions as it targets energy use rather than greenhouse gas emissions. The levy penalises nuclear power and other non-emitting sources, which are effectively carbon free. It also excludes certain energy users, including households and transport, which are large emitters of CO<sub>2</sub> emissions.

#### *EU emissions trading scheme*

In the first two periods of the EU trading scheme the majority of emissions are set to be allocated free of charge through a 'grandfathering' mechanism i.e. the allocation of permits based on past emissions. In the first period (2005-7) participating member states are required to allocate at least ninety-five percent of

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<sup>1</sup> In the rest of this submission the term carbon tax is also intended to embrace related economic instruments such as auctioned permits

allowances free of charge (EC 2003), whilst in the following five year period this is expected to be lowered to ninety percent of overall allowances.

The free allocation of the majority of emissions within the EU emissions trading scheme weakens its impact as a tool to generate emission reductions. We consider that whilst the grandfathering allocation method is an adequate mechanism to initiate an emission trading scheme, it provides polluters with a strong incentive to disguise business-as-usual reductions as reductions brought about by commitment to the trading programme. Subsequent allocation of emission permits should be auctioned, where polluters pay for permits, and are unlikely to pay for a reduction that would be achieved without the trading system.

Critically, the revenue derived from the auctioning of emissions should be recycled back into the economy. Economic studies have shown that with this feedback there is virtually no significant loss of GDP (Royal Society 2002).

### **What more should the Government be doing to ensure new technologies are available to maximise further cost effective carbon savings for the energy supply sector up to 2020?**

#### *Energy supply mix*

We are concerned that the measures in the current Climate Change Programme will not deliver the outlined CO<sub>2</sub> emission targets. After this assessment process the Government will have to show political courage to introduce new measures that will be required to make substantial cuts in CO<sub>2</sub> emissions. As we outlined in a statement prior to the publication of the Energy White Paper (2003), unless the rate of development of both renewables and energy efficiency measures makes up for the loss of capacity resulting from the phase out of nuclear power, the UK will become more reliant on fossil fuels, which is not consistent with the overall aim of drastically reducing our carbon dioxide emissions.

Commissioning new or replacing some of the existing nuclear power stations should be accompanied with a strategy for the long-term management of radioactive wastes.

The recent announcement by the DTI (DTI 2005) to participate in international research collaboration on nuclear energy is welcome. This highlights the importance of ensuring the UK retains and develops expertise in this field if it is to keep the nuclear option open.

#### *Renewables*

The Government has made some progress towards the development of the renewables industry and reaching the ambitious 10% target by 2010. Some substantial barriers still remain to the development of the wind industry, including the number of wind farm pre-applications objected to by the Ministry of Defence, low investor confidence in the industry and local opposition.

We welcome the introduction of funding for tidal and wave renewables demonstration projects. However we have some concerns that the limit on a 5 year contract period is too short to bring forward large-scale systems needed for tidal power.

Analysis in our economic instruments report (Royal Society 2002) shows that tidal systems are competitive with other renewable sources and small increases in the price of carbon emissions could make these systems economically viable. A long term stable environment is required to secure the capital investment to provide these technologies.

#### *Carbon capture and storage*

The Review consultation document highlights that the future Carbon Abatement Strategy will set 2020 as a target to bring carbon capture and storage technologies to market. In principle, we support this policy, however we are concerned that by 2020 the window of opportunity would have been missed to take full advantage of the existing infrastructure in the North Sea. We also emphasise the importance of including robust scientific assessments in the future use of such technology.

### **What further measures could be introduced to stimulate further carbon savings from improving energy efficiency in households in the period through to 2010?**

Energy is currently too cheap to provide the motivation for maximising household energy efficiency. As we stated above, the correct economic measures can provide significant incentive for driving energy efficiency measures; however correct regulation and Government funding can also provide motivation for households to make investments to their property, with long pay back periods.

Part L of the Building Regulations has been an effective measure for reducing building energy consumption in the last two decades, but it has only a limited impact on the existing building stock. Dealing with the existing stock should be seen as a priority.

### **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?**

Development of the hydrogen economy, especially in vehicle use, could help deliver a greener environment. The recently published Strategic Framework for Hydrogen (E4tech et al 2004) highlighted that hydrogen energy could provide competitive CO<sub>2</sub> reductions for road transport energy by 2030. A number of technical and engineering barriers still exist to the development of hydrogen economy. The Government should provide the necessary funding and incentives to drive research advances in this area.

Whilst clean fuels are being developed, the Government needs to do more to reduce CO<sub>2</sub> emissions from cars. Economic instruments should be implemented to make alternative methods or fuels of transport relatively more economic and efficient.

We are planning a seminar in early summer on improving co-ordination of research and policy in order to overcome some of the current technical and political barriers to the hydrogen economy. As part of the contribution to the UK Government's campaign for a year of British science in China, at the end of May, we are also holding a Royal Society networking event on hydrogen with the Chinese Academy of Sciences in China.

### **What is the scope for or restraint on increases in carbon sinks through forestry?**

The 2001 Royal Society report on the role of land carbon sinks in mitigating climate change highlighted that there is still uncertainty in the scientific understanding of the causes, magnitude and permanence of the land carbon sink. The report concludes that, based on current knowledge, the potential to enhance the land carbon sink through changes in land management practices is uncertain in size and duration.

We recommend that methods used in the production of forest and agricultural crops should be modified to reflect their potential role in increasing the global land sink. Considerable political will is required to drive global changes in agricultural and forestry practices, including a decrease in deforestation, to develop sinks to help reduce CO<sub>2</sub> emissions.

Using the lower scenarios of future greenhouse gas emissions outlined by the Intergovernmental Panel on Climate Change (IPCC 2001), hence looking at the lower end of the range of predicted mean surface temperature increases, the benefit of changing land management practices can be estimated. We concluded (Royal Society 2001) that these changes could lead to a maximum of 25% reductions in CO<sub>2</sub> required globally by 2050 to mitigate adverse impacts of climate change. However there could be little potential for increasing the sink thereafter. The permanence of the land carbon sink is uncertain with climate models projecting that future warming could cause its magnitude to increase less rapidly, saturate or even be converted to a source of CO<sub>2</sub> later in the century.

The amount of CO<sub>2</sub> that can be sequestered in these sinks is small in comparison to the ever-increasing global emissions of greenhouse gases. Projects designed to enhance land carbon sinks must therefore not be allowed to divert financial and political resources away from the restructuring of energy generation and use.

**What further evidence of the impacts of climate change is needed to enable effective adaptation? With regard to the natural environment, how should we develop our approach to evidence gathering, strategic prioritisation and adaptation action?**

Whatever mitigation strategies are agreed, some impacts of climate change are now inevitable and adaptation is essential and unavoidable. The primary challenge for science to aid effective action is to provide society with information indicating where changes are likely to occur and the implications for the environment, human livelihoods, health and prosperity. Modeling these impacts is an immense but important challenge.

Important areas for further understanding include research into the non-linear feedbacks between climate change and its impacts. Improving understanding and predicting the impact of climate variability and change on agriculture, especially in the tropics, is also a critical research issue. Globally all societies will have to adapt to changes in the distribution of crops under climate change.

Within all environmental models there is uncertainty owing to physical processes that are either not completely understood or yet to be adequately represented because of limited computer power. By averaging an ensemble of model experiments uncertainty can be estimated. The future should therefore involve using ensembles of state-of-the-art, high resolution, global Earth System Models (ESMs), which allow the effects of non-linear "surprises", variability, and extreme events to be integrated in a self-consistent way within the probabilistic framework required by societal risk assessment.

*Please send any comments or enquires about this submission to:*

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