



Secretary of State
Department for Energy and Climate Change
Whitehall Place

7th October 2008

From Lord Turner of Ecchinswell

Dear Ed,

Interim advice by the Committee on Climate Change

Hilary Benn asked me, if I were able, to set out the Climate Change Committee's recommendations for the UK's 2050 target before the publication of our first report. Thanks to the hard work of the Committee and its Secretariat, I am in a position to do so. Our recommendations are that:

- **The UK should aim to reduce Kyoto greenhouse gas emissions by at least 80% below 1990 levels by 2050. This would be an appropriate UK contribution to a global deal aiming to reduce Kyoto gas emissions to between 20-24 billion tonnes by 2050 (between 50-60% below current levels).**
- **The costs to the UK from this level of emissions reduction can be made affordable – we estimate between 1-2% of GDP in 2050 - with appropriate policies and trajectories. Our estimates are the same order of magnitude as those provided by the Stern Review and other estimates for global emissions reductions.**
- **The 80% target should apply to the sum of all sectors of the UK economy, including international aviation and shipping. To the extent that international aviation and shipping emissions are not reduced by 80%, either these sectors would have to purchase credits, or more effort would have to be made in other sectors. We therefore recommend that the emissions reduction target for those sectors covered by the Climate Change Bill should be *at least* 80%.**

We summarise the analysis that underpins these conclusions in 6 sections:

1. What has changed since the UK adopted a 60% target

2. Our approach to determining a climate objective
3. Global emissions reduction trajectories consistent with our climate change objective
4. Appropriate UK contributions to global emissions reductions
5. Costs of reducing emissions
6. Coverage of the proposed target

We will provide a full account of this analysis in our report to Government on December 1st.

1. What has changed since the UK adopted a 60% target

The Committee looked at whether the UK's current target for a 60% reduction in CO₂ emissions by 2050 was likely to be sufficient given what we know about the latest developments in climate science. This target was recommended in the report by the Royal Commission on Environmental Pollution (RCEP) published in 2000. Since the report, however, new information has become available. This suggests that the dangers of significant climate change are greater than previously assessed which argues for larger global, and thus UK, reductions. In particular the Committee has considered six changes:

- Firstly, we know more about how rising temperatures will reduce the effectiveness of carbon sinks: the science now tells us that for any given level of emissions, concentrations of greenhouse gases (GHGs) and temperatures will increase by more than the RCEP report anticipated.
- Secondly, unlike the authors of the RCEP report we had the benefit of models that included the warming effects of gases other than CO₂. The Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4) shows that, for the stabilisation level outlined by RCEP, non-CO₂ gases will increase the equivalent CO₂ concentration in the atmosphere by approximately 100ppm.
- Thirdly, the reduction in the summer Arctic sea ice in recent years has been greater than predicted by any of the models. Also the summer melt of the Greenland ice sheet has accelerated. These observations have led to new concerns about the pace of global warming, particularly as it affects the Arctic and possible rates of sea level rise.
- Fourthly, it is now realised that atmospheric pollution has probably masked some of the greenhouse gas warming that would have occurred. As air quality improvements continue to be achieved, so even more warming can be expected.
- Fifthly, there is now a greater understanding of the range of potential climate change impacts, their regional variation and the possibility of abrupt or irreversible changes. These analyses also suggest greater damages once temperature increases become significant.
- Finally, latest global emission trends are higher than those anticipated in most IPCC scenarios, largely because of higher economic growth and a shift towards more carbon intensive sources of energy.

We therefore believe that there is a very strong case for setting a significantly higher reduction target than the 60% proposed by RCEP in 2000.

2. Our approach to determining a climate objective

To determine a UK emissions reduction target, we first considered what a global target should be and then the UK's appropriate contribution. The global emissions target needs to be based on an analysis of the climate science. The crucial issue is what level of global temperature should the world seek to avoid, and what emissions path will keep us below this temperature. The challenge in this approach is that there are many uncertainties in the relationships between emissions of GHGs, their concentrations in the atmosphere and the local and global temperature and climate impacts that result. The Committee considered three categories of uncertainty:

- Feedback loops in the climate system which may amplify temperature increases (some of which may not be properly captured in models) e.g. release of methane stored in permafrost and oceans;
- Potential impacts which may be effectively irreversible once a temperature threshold is passed e.g. melting of Greenland ice sheets; and
- Uncertainties in the relationship between temperature changes and damages. Some of these may be non-linear – the world may be able to adapt to small changes in temperature change, but once higher increases are experienced damages will exceed the adaptive capacity of many biological, physical and social systems.

Given these uncertainties climate science cannot predict, with absolute certainty, how emissions paths will translate into temperature increases and how temperature increases will translate into damage. Deciding what level of temperature increase is harmful is therefore inherently judgemental. The Committee's judgement, on the basis of the IPCC AR4 report, is that adverse human welfare consequences are likely to increase significantly if global temperature rises more than 2°C relative to pre-industrial temperatures, and that if a 4°C rise were reached, extreme consequences potentially beyond our ability to adapt would arise. We therefore believe that global policy should seek to limit the central expectation of global temperature rise to, or close to, 2°C and that it should ensure that the probability of crossing the extreme danger threshold of 4°C is reduced to an extremely low level (e.g. less than 1%).

3. Global emissions reduction trajectories consistent with our climate change objective

The Hadley Centre has conducted for us an analysis of how different global emissions paths might translate into a probability distribution of future global temperature increases. On the basis of this analysis, the Committee has concluded that, in order to fulfil the criteria set out above, global Kyoto GHG emissions need to fall to between 20-24 billion tonnes by 2050 – or 50-60% lower than current levels - and to a still lower level of 8-10 billion tonnes by the end of the century:

- Reducing emissions to 20 billion tonnes in 2050 would, according to our central model estimates, lead to a CO₂ equivalent (CO₂eq) concentration around 460ppm by 2200. By 2100 this would result in a temperature increase of close to 2°C. It would keep the estimated probability of a 4°C rise by 2100 at an extremely low level.
- Reducing emissions to 24 billion tonnes in 2050 would, according to our central model estimates, lead to a CO₂eq concentration of over 480ppm by 2200. By 2100 it would result in a central estimated temperature increase of under 2.2°C. It would also keep the probability of 4°C rise by 2100 below at a very low level.

- Accepting a significantly higher emissions level in 2050, say modest growth from today's levels to around 48 billion tonnes, would, according to our central model estimates, lead to a CO₂eq concentration of over 650ppm by 2200. By 2100 it would result in a central estimated temperature increase of nearly 2.8°C. It would also increase the probability of a 4°C rise in 2100 to just under 10%.

4. Appropriate UK contributions to global emissions reductions

The appropriate UK share of a global emissions target involves ethical judgements and will be the subject of international negotiations. A range of methodologies for allocating emissions reductions between countries have therefore been proposed. Most of these methodologies base emission reduction targets on per capita emissions, abatement costs or income. They differ in relation to the time when different countries begin emissions reductions, the rate at which they then reduce emissions, and the extent to which already industrialised countries should have to compensate for historic emission levels.

It is not part of the Committee's remit to propose a specific methodology for the purposes on international negotiations. But we believe that it is difficult to imagine a global deal which allows the developed countries to have emissions per capita in 2050 which are significantly above a sustainable global average. In 2050 the global average, based on an estimated population of 9.2 billion, would be between 2.1 to 2.6 tonnes per capita, implying an 80% cut in UK Kyoto GHG emissions from 1990 levels.

5. Costs of reducing emissions

Meeting an 80% target would be challenging but feasible based on a range of options for reducing emissions including:

- Energy efficiency improvement in buildings and industry (e.g. loft and cavity wall insulation, use of more efficient appliances, turning appliances off and using less air conditioning), which will be particularly important for reducing emissions in the period to 2020.
- Decarbonisation of the power sector, starting now and continuing through the 2020s, based on replacing existing conventional fossil fuel fired plant with renewable technologies (e.g. wind, tidal), nuclear new build and CCS.
- Transport sector decarbonisation, first through improving fuel efficiency of conventional engines and increased use of sustainable first generation biofuels, with progressive introduction of new technologies such as electric cars, plug in hybrids and hydrogen vehicles, and second generation biofuels.
- Heat sector decarbonisation through increased use of biomass in boilers and CHP, air exchange and ground source heat pumps, and modern electric storage heating.
- Decarbonisation of industry through the introduction of new technologies such as CCS in cement, iron and steel.

We have looked at a range of cost estimates for our proposed global emission reductions. Drawing on analysis by the IPCC, the International Energy Agency and in the Stern Review, we believe these fall in the range of 1-3% of GDP in 2050. We have also assessed UK costs of meeting an 80% reduction target, which we estimate to be between 1-2% of GDP in 2050. The Committee believes that this level of cost is affordable and that it is appropriate to accept it given the potential consequences and costs of inaction.

6. Coverage of the proposed target

Our recommended 80% target covers all Kyoto GHGs and all sectors of the UK economy. This raises a question over whether the coverage of the Climate Change Bill should be extended to include non-CO₂ gases together with international aviation and shipping. The principle here is clear: any climate change strategy should cover all GHGs and all sectors. Consistent with this, legally binding budgets and targets under the Bill would *ideally* be expressed in these terms.

Regarding non-CO₂ gases, inclusion raises questions around measurement uncertainty e.g. the uncertainty surrounding the level of current UK GHG emissions is approximately 14% compared to only 2% for UK CO₂ emissions. There is also some uncertainty in their quantitative equivalence to CO₂ in terms of effects on climate. The Committee's assessment, however, is that these are important but manageable, and that the benefits of setting budgets and targets in terms of GHGs rather than CO₂ outweigh the drawbacks. Our recommendation is that if and when our proposed 2050 target enters legislation, this should be in terms of GHGs.

Regarding international aviation, while there are methodologies that could sensibly allocate emissions to the UK level (e.g. bunker fuels), these differ from the methodology that has been proposed for entry of aviation into EU ETS. We do not believe that the EU ETS methodology is an appropriate basis for inclusion of international aviation in UK budgets but we are also concerned that if international aviation was included on a different basis from that used in the EU ETS then confusion would result.

In the case of international shipping, there is significant uncertainty over how emissions should be allocated to the UK. Ships arriving in the UK, for example, may have called at numerous ports en-route, unloading and loading cargo along the way. Given this uncertainty, it is not clear how international shipping emissions could be sensibly included in UK budgets. The focus in international shipping should be towards getting a global agreement to reduce emissions from this sector.

Given these practicalities, our recommendation is that the scope of the Climate Change Bill should not be extended to include international aviation and shipping. To reiterate, however, it is essential that both these sources of emissions should be included in the UK's climate change strategy. The implication of this is that budgets and targets should be higher to the extent that international aviation and shipping emissions do not fall sufficiently. For this reason, we recommend that the 80% GHG should be regarded as a minimum (average) target for those sectors covered by the Bill, with further reductions required if international aviation and shipping emissions are not on track to deliver an 80% reduction in 2050. We will revisit what this

appropriate adjustment might be in the context of the evolving international frameworks for aviation and shipping.

We will further be recommending that the Committee's annual reports of progress against the budget should also report on the UK's trends in international aviation and shipping emissions (e.g. based on bunker fuels and other appropriate methodologies), their climate impact, the success of abatement efforts and appropriate policy levers.

Yours ever,

A handwritten signature in cursive script that reads "Adair Turner". The signature is written in a light grey or blue ink.

**Adair Turner
Chair, Committee on Climate Change**