

GLOBAL WARMING: MEETING NEW TARGETS

- *New national target of 20% cuts in CO₂*
- *How great a challenge?*

At the recent G8 Summit and UN 'Earth Summit II', international divisions were apparent on policies to combat global warming, particularly on targets to restrain emissions of the main greenhouse gas carbon dioxide (CO₂)¹. The UK is one of the few countries likely to meet the first UN target (for 2000), and the previous Government had accepted a target of a 10% cut by 2010 (relative to 1990). The new Government has increased this to 20%.

This note examines the implications of the latest targets and the issues raised.

ORIGIN OF THE TARGETS

The 1992 Framework Convention on Climate Change (FCCC) addressed concerns that man-made emissions of greenhouse gases (GHGs) were warming the Earth and leading to climate change (see POSTnotes 16, 33 and 61). Under the original agreement, the UK and other developed countries were committed to return emissions of the main GHGs to their 1990 levels by the year 2000 (**Box 1**). However, the first Conference of the Parties (COP1) in 1995 agreed that this was insufficient, and the COP2 Ministerial Declaration in 1996 agreed that **legally binding targets for reductions after 2000 should be set by 1997** (at a conference in Kyoto in December).

Within the EU, Ministers agreed (March 1997) to propose in FCCC negotiations that all developed country GHG emissions should be reduced by 15% by 2010 (relative to 1990), and adopted (June 1997) an interim target for the EU of 7.5% by 2005. Under a policy of 'burden-sharing', some EU countries can increase emissions because of their level of technological and economic development (**Table 1**). So far, only 10% of the 2010 15% target has been assigned in this way, and further negotiation will assign responsibility for the rest. The UK's contribution was to reduce emissions by 10%, but the new Government now intends to cut emissions of the main greenhouse gas (CO₂) by 20%.

SOURCES AND TRENDS IN UK CO₂

While CO₂ is not the only GHG¹, it is the most important; moreover, in the UK its source is largely from burning fossil fuels. The four key sources in the UK are: power stations (30% of 1994 emissions); transport (23%); industry and services (32%); and the domestic sector - mostly from central heating (15%).

1. Of the 38 GHGs identified by IPCC, the main ones are CO₂, methane (CH₄), nitrous oxide (N₂O) and CFCs/HFCs etc. CO₂ accounts for over 60% of enhanced global warming; CH₄ 20%, N₂O 10%; other gases 10%.



**POST
note** **100**
July
1997

POSTnotes are intended to give Members an overview of issues arising from science and technology. Members can obtain further details from the PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY (extension 2840).

Box 1 GREENHOUSE GAS TARGETS

In 1988 the Intergovernmental Panel on Climate Change (IPCC) was established to examine the science of global warming, its potential effects, and what responses might be appropriate (see POSTnotes 16, 33, 42 and 61). Following IPCC's first report in 1990, 137 countries signed the United Nations Framework Convention on Climate Change (FCCC) at the 1992 Earth Summit in Rio de Janeiro, committing the UK and other countries to "stabilising greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system". The Convention requires that changes should occur at a rate that allows ecosystems to adapt naturally, and not threaten food production or economic development. Currently, IPCC predicts that global average temperatures will rise by 1-3.5°C over the next 100 years, which is a rate not experienced before, and predicting the detailed effects on climate remains uncertain.

Translating the general wording in the FCCC into numbers is difficult, but IPCC suggests that temperature rises above 1°C, and rates of change greater than 0.1°C per decade could cause significant adverse effects. The EU Council of Ministers has suggested that global average temperature should not rise by more than 2°C (requiring CO₂ concentrations to be stabilised at no more than 550 ppm - twice pre-industrial levels), and that this should guide global reduction efforts. IPCC calculates that to meet this upper limit in the long term, global emissions would need to be cut by 36% by 2150, while stabilising atmospheric concentrations at their current level now would require immediate cuts of 50-70% globally.

Following the lack of consensus at the New York UN 'Earth Summit II' meeting, the key to progress will be the next FCCC meeting (COP3) at Kyoto, and this is meant to decide on legally-binding targets for after 2000. The Alliance of Small Island States (those most at risk from sea-level rises) are calling for a 20% interim reduction by 2005 (supported by environmental groups), leading to a 40% cut by 2010. In contrast, energy interest groups such as the Global Climate Coalition and some States (e.g. some OPEC States) oppose reduction targets altogether.

Table 1 EU Greenhouse Gas Reductions by 2010

Country	Change	Country	Change	Country	Change
Luxembourg	-30%	Belgium	-10%	Sweden	+5%
Denmark	-25%	UK	-10%	Ireland	+15%
Germany	-25%	Italy	-7%	Spain	+17%
Austria	-25%	France	0%	Greece	+30%
Netherlands	-10%	Finland	0%	Portugal	+40%
EU TOTAL	-10%				

Department of Trade and Industry (DTI) projections of CO₂ emissions to 2020 (**Figure 1**) show that overall emissions are expected to fall between 1990 and 2000, meeting the original target of returning 2000 emissions to 1990 levels. However, on current trends, emissions will rise again to between 3% under and 5% over 1990 levels by 2010 (**Table 2**), thus missing both the old and new Governments' targets of 10% (for GHGs) and 20%

(for CO₂) reductions respectively. Looking at each sector of the economy, Table 2 shows that only the electricity supply industry (ESI) is likely to reduce emissions (by 17-30%), while other sectors' emissions will increase on current trends.

HOW CAN TARGETS BE MET?

The UK's recent good performance has been as much by accident as design, and can be attributed to the 'dash for gas' in the ESI and a greater than expected nuclear output. Further cuts will require a reversal of growing trends in the other sectors which have so far proved resistant to change. Overall, to meet a 20% target, emissions will need to be reduced by 20-40 million tonnes of carbon (MtC) relative to DTI's current 2010 forecasts. DoE and DTI are looking at how this may be achieved but revised projections are unlikely before end 1997. The UK National Programme for CO₂ emissions beyond 2000 may not be revised until mid-1998 - after the outcome of COP3 in Kyoto is known (Box 1).

On the individual sectors, **transport** emissions have grown from 13% of the UK total in 1980 to 22% in 1994, and are projected to increase by 6-13MtC/yr by 2010 - taking transport's share to ~25%. CO₂ emissions are reduced with more fuel-efficient vehicles, and current policies to increase road fuel duty annually by at least 5% provides an incentive to increase fuel efficiency and to drive less. Recent emphasis has been on raising public awareness about the consequences of increasing traffic; reducing car dependency; and improving choices between different modes of transport through an integrated transport policy. The 1997 Road Traffic Reduction Act also requires local authorities to draw up plans to reduce traffic in their areas.

Were the transport sector to make cuts in emissions in proportion to its contribution, then it would need to cut emissions 20% - by 4-9 MtC/yr by 2010. **This is in direct conflict with current trends for an increase in emissions of 5.6 to 12.6 MtC.** Put another way, transport sector emissions would have to be 30-43% below the levels currently forecast for 2010 if it pulls its weight as a sector! The Royal Commission on Environmental Pollution (RCEP) and POST² considered this in 1995.

Many research ideas aim to produce a car with 3 times the fuel efficiency of current ones, and use alternative fuels such as natural gas and electricity. Under current market conditions however, average fuel efficiency has actually fallen in recent years, and **relying on technology alone to deliver emission reductions would carry a high risk of failure.** Market signals to encourage higher efficiency (e.g. higher fuel prices, differential car tax) would help, as might current 'cars of the future' research projects in the USA, EU and UK. But inevitably reducing journeys must have an equally if not more important role to play.

Figure 1 UK CO₂ Emissions, 1985-2020

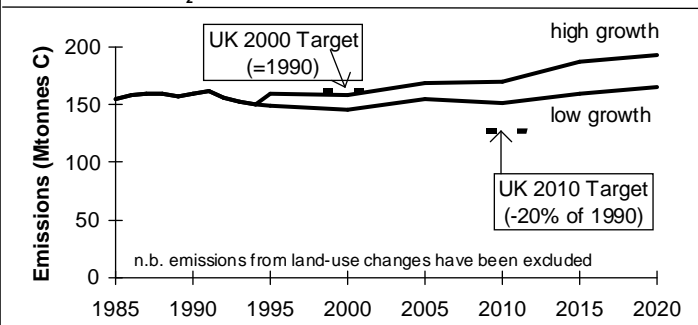


Table 2 CHANGES IN CO₂ EMISSIONS, 1990-2010

Sector	1994 (MtC)	Minimum	Maximum
ESI	44	-17%	-30%
Industry, services	49	+3%	+5%
Residential	23	+2%	+5%
Transport	34	+17%	+38%
ALL	150	-3%	+5%

This could involve a modal shift from cars/lorries to means which emit less CO₂ per kilometre travelled (this can be much lower for rail (by 30-60%), bus (20-60%) and cycle and walking (by 100%)); or reductions in the overall need of people and goods to travel. In the latter context, it helps to distinguish between people's real need, which is **access** to goods and services, and the means of achieving it, which is **mobility**. Continuing to provide or enhance access, while reducing mobility bears most significantly on the role of land use planning, and measures announced by the previous Government (e.g. in planning guidance) had started to consider the need to restrain the demand for travel.

The Industry and Services sector uses electricity and creates direct CO₂ emissions from boilers, furnaces, etc. The primary means of reducing emissions in this sector is to improve energy efficiency, and there are many Government-supported initiatives in this area. For instance, the Energy Efficiency Management Directorate's Energy Efficiency Best Practice Programme (EEBPP) provides information on energy saving, and collaborates in research into new efficiency technologies. There is also the 'Making a Corporate Commitment' programme, aimed at top management to promote the financial and environmental benefits of energy saving, with nearly 2,000 participants by the end of 1996. Nevertheless, there remains a large gulf between what is technically and economically feasible and current and projected practice. EEBPP can show that energy and CO₂ savings of ~30% are technically feasible and may be economic now; much higher savings could be achieved with emerging technologies, but would not necessarily be cost-effective. Despite this, DTI projections envisage an **increase** in CO₂ emissions from this sector of 3-5% by 2010, because of continued slow take-up of the relevant technologies. Options to improve this include expanding advisory roles of organisations such as EEBPP, greater use of combined

2. See 1995 report on "Transport : Some Issues in Sustainability".

heat and power (CHP), fiscal incentives for energy efficiency, 'green' accounting in company reports, as well as further technical development to bring leading-edge technologies nearer to the market.

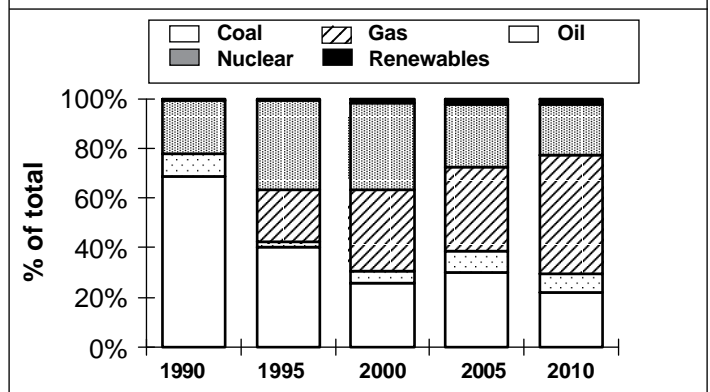
Households emit directly 15% of the UK's CO₂, but also consume electricity, so that this sector is really responsible for 27% of UK emissions. Anticipated reductions in the VAT rate on fuel (to 5%) are expected to increase energy consumption slightly. Again energy efficiency is the key to reducing demand - primarily through energy-efficient appliances and improving the insulating properties of buildings. Measures include the Energy Savings Trust; energy and eco-labels on appliances; minimum energy efficiency standards; fuel price rises through VAT on domestic fuel; grants for energy efficiency equipment and materials; home energy ratings to advise home-owners and potential purchasers on the energy efficiency of properties; localised CHP schemes; and The Home Energy Conservation Act, 1995 which requires local authorities to improve domestic energy efficiency by 30% over the next 10-15 years.

EST and the EEBPP suggest that domestic CO₂ emissions could be reduced economically on current technology by ~25%, and leading-edge technologies offer greater potential. Barriers to achieving this include:

- High initial capital costs of efficiency measures, often with long pay-back times.
- 'Rebound' effects where people use efficiency gains to increase comfort rather than save energy.
- Lack of public awareness of the need to save energy and of the link with global warming.
- In rented accommodation, landlords pay the costs, while tenants receive the benefits.
- Slow turnover rate in housing stock and appliances.
- Low priority given by consumers to energy efficiency (e.g. energy efficiency varies by a factor of three in appliances and is not price-related).

Achieving large reductions in the above sectors goes against the rising trends in recent years, and raises the question how far the ESI can be expected to 'help out' after 2000. The main reason for reductions in **ESI emissions** is the shift in power station fuel from coal to gas since privatisation (**Figure 2**) - gas's share rose from less than 1% in 1990 to 17% by 1995, and is expected to reach 50% by 2010. At the same time, nuclear power (which produces negligible amounts of CO₂) has also increased its share with Sizewell B coming on line and improved productivity from other stations. But, as existing stations reach the end of their working lives, nuclear power will decline - from 25% in 1995 to ~14% by 2010. In the absence of new nuclear plants, gas-fired power stations are most likely to take their place - plugging this 'gap' with gas adds 4MtC yr of CO₂ by 2010. The previous Government encouraged renewable sources of energy, which now provide ~2% of UK

Figure 2 FUELS FOR ELECTRICITY GENERATION, 1990-2010



electricity. Some of these contribute little to CO₂ emissions (wind, wave etc.); others (waste incineration) do, but because of the low market penetration, they have yet to significantly affect national emissions.

The sensitivity of CO₂ emissions to future ESI fuel mixes was addressed by the National Academies Policy Advisory Group (NAPAG) recently. This pointed out that containment at 1990 levels after 2000, let alone a reduction required:

- a vigorous programme of improvement in energy efficiency across all sectors of the economy;
- further shifts from coal to gas;
- a substantial increase from renewables;
- no substantial fall in nuclear generation.

If the ESI were faced with delivering half the target reduction of 20%, NAPAG calculates that, with energy demand growing as in current DTI forecasts, and gas kept to 50% of the market, there would be **no room for coal³, and renewables and nuclear would have to generate 45% of national electricity. Even if energy efficiency progress was better than official forecasts (0.5% p.a.), and gas produced 54%, nuclear and renewables would still have to generate 40%. A policy to maintain a role for coal at all would require even more nuclear/renewable and reduced gas.**

The gap between such scenarios and current trends is profound. Renewables account for 2% now and less than a third of projects authorised under the current Renewables Orders (POSTnote 32) have been commissioned, due mainly to difficulties in raising finance and local opposition to planning applications. DTI projections assume that renewables may increase to only 3% by 2010. The new Government has set a target of 10% of electricity from renewables by 2010 and options to achieve this could include strengthening planning policy guidance; developing renewable energy offshore (e.g. wind and wave power); more CHP; and encouraging consumers to buy 'green' energy services (including electricity from renewables). The potential of nuclear power to maintain its contribution to CO₂ targets appears unlikely to be realised under current trends.

3. Natural gas produces less CO₂ per unit of electricity generated (~14 kgC/GJ) than coal (25kgC/GJ).

ISSUES

Since the 1992 Rio conference, IPCC figures show that global emissions of CO₂ have increased 2%, but this hides substantial variations - e.g. Eastern Europe has fallen by 14%, while some developing nations have increased substantially (e.g. Southeast Asia by 32%) and other developed nations significantly (e.g. USA by 3%, Australia by 10% and Canada by 5%). In comparison to such performance, the UK's achievements appear very positive and, with the policy of a 20% cut by 2010, has placed the UK in the role of leader in the international debate on this issue in the run-up to Kyoto.

The brief overview above however shows that meeting such a target would require more specific policies than those achieving the reductions to date. Further, the size of the gap persuades many that **policy in the ESI cannot be left to the outcome of the combined effect of market forces under different industry regulators** and will require a policy direction if energy supply options are to be devised which combine security of energy supplies with national environmental obligations.

Improving energy efficiency is one of the most critical factors, and is one of the 'no-regrets' policies long advocated by the Lords' Science and Technology Committee, the RCEP and others to reduce CO₂ emissions with neutral or beneficial economic consequences. The gap between what is 'achievable' and what is implemented remains large and suggests that current initiatives aimed at education and information and limited grant schemes (such as for household insulation) are unlikely to deliver the required future reductions. Even in the public sector, progress has been slow with CO₂ emissions reduced by only 10% since 1990.

The solutions are political, economic and scientific; e.g.:

- **Increasing knowledge** of availability and benefits of energy and resource-efficient technologies.
- **Pricing signals** to industry and consumers (e.g. by removing subsidies for fossil fuels/increasing duty, taxing emissions of CO₂ (the 'carbon tax') and inefficient resource use, providing investment credits or zero VAT-rating energy efficiency measures).
- **Encouraging the provision of energy services rather than supply** - this allows (e.g.) regional electricity companies to meet customer needs by reducing demand rather than increasing supply.
- **Tightening energy efficiency standards** on buildings, goods and processes.
- **Improving efficiency in transport** by a shift to public transport, walking and cycling, as well as **by reducing the demand (see above)**.
- **Expanding R&D** into energy efficient technologies to accelerate the use of leading-edge technologies.

A key question will be **whether to apply the national target of 20% reductions equally to all sectors**. In

favour is that sectoral targets appear more equitable by apportioning the required savings according to responsibility, by identifying specific goals for manufacturers, suppliers and customers rather than relying on a general national aim to reduce CO₂. Sectoral targets may however affect the competitiveness of each sector to different degrees and it would make economic sense to cut emissions in the most cost-effective way, regardless of from which sector they originate. The key here however would be to avoid protracted arguments over which sector should be charged with which targets.

The UK's adoption of a 20% reduction target contrasts with the lack of progress at the UN in June, and discussions at Kyoto in December are likely to be difficult. Some of the areas of dispute likely are:-

- 1 Whether to adopt **simple flat-rate reductions** - where all countries agree to reduce emissions, say, by 15% by 2010; **formula-based reductions** to decide on each country's target; **case-by-case reductions** - where country-specific targets are negotiated; **per capita reductions** - targets set based on an agreed ceiling on the total emissions per person.
- 2 Reductions might be based on a **'basket'** of greenhouse gases (i.e. methane, nitrous oxide and CO₂) rather than just CO₂. This has a scientific rationale, but would complicate measurement and monitoring countries' success or failure.
- 3 Some are arguing for reduction commitments to be **tradeable** - between countries (e.g. the UK could invest in renewable energy in India and claim the CO₂ savings) or between sources and sinks - the USA might achieve part of any reduction by funding a new forest in South America to 'capture' CO₂ - so-called 'Joint Implementation'.

But the key issue after the G8 Summit and New York appears to be continued reluctance by some developed nations (USA, Japan and Canada among the G8) to accept legally-binding commitments to CO₂ reductions and/or to link this with restraint by developing nations on their future growth. Some argue that without this, developed nations may be put at a competitive disadvantage. Others argue that with the *per capita* emissions of the developed world so far ahead (e.g. average emissions per person per year are (in tonnes C): USA 5.3; UK 2.7; Japan 2.4; South Korea 1.7; China 0.6; Africa 0.3), a credible start on reduction needs to be made now in developed countries to set an example, while technology transfer encourages the developing world to develop in an energy efficient manner, avoiding the wasteful phase of earlier economic transitions. In this context, the EU burden-sharing which allows Portugal and Greece 40% and 30% increases respectively is seen by many as undermining calls by developed countries for restraint by developing nations.