

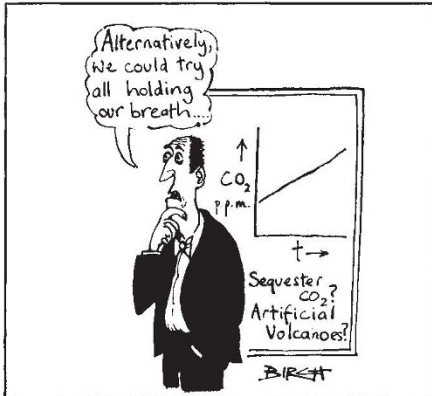
## Greenhouse effect

## Energy efficiency may help

Washington

ALTHOUGH a global warming due to a build-up of atmospheric carbon dioxide is inevitable, it can be postponed significantly by improved energy efficiency, according to a new study prepared for the National Science Foundation\*. The report, by engineers at Massachusetts Institute of Technology (MIT) and Stanford University, breaks with recent studies by the Environmental Protection Agency (EPA) and the National Academy of Sciences (NAS) in suggesting that practical and effective steps can be taken at once to soften the blow of a warming induced by carbon dioxide. By drawing out to several centuries the time it will take for the atmospheric carbon dioxide concentration to double, society will buy time to develop new energy technologies and to enable agriculture and population distributions to adjust to climatic shifts.

The study found that "realistic energy strategies" based on improvements in energy efficiency could hold the atmos-



pheric carbon dioxide concentration to 420 p.p.m. by the year 2050, up from 340 p.p.m. at present. Based on the recent experience of the United States and other industrialized countries, the report concludes that energy use per real dollar of gross national product can be expected to fall by 1 per cent per year.

"It makes sense to develop strategies for reducing fossil fuel carbon emissions, rather than relying solely on research to narrow uncertainties and/or ameliorative measures such as building dikes and developing new strains of 'greenhouse-resistant' crops", the report says. EPA last year suggested that there was little point in trying to halt the carbon dioxide build-up; the NAS report suggested that uncertainties in model predictions (which point to an average global warming of a few degrees centigrade for a doubling of atmospheric carbon dioxide) preclude any immediate steps to halt the build-up.

The NSF study, however, noted that increased energy efficiency, apart from being the only practical route to slowing the build-up of carbon dioxide, is economically attractive in its own right.

The NSF report found that solar and renewable energy technologies are not likely to displace fossil fuels to a sufficient extent to make a significant difference in carbon dioxide emissions in the short run. Nuclear fission, because it will probably be considerably cheaper than coal (especially if acid rain prompts new emission controls on sulphur), is seen as the only energy technology besides improved efficiency with a major short-term effect on atmospheric carbon dioxide.

The study discounted strategies to extract carbon dioxide from fossil fuel combustion and sequester it, for example, in deep ocean waters. This is only one of

## Acid rain

## Uncertainty persists in Europe

A REPORT on acid deposition in Britain prepared by the Warren Spring Laboratory for the UK Department of the Environment highlights the need for a long-term programme of measurement on acid precipitation. Asked to examine the distribution in Britain and time trends of acidity in precipitation in Britain and northern Europe, the authors were able to consider only a part of Britain's land surface for lack of measurement stations between which comparisons could be made.

The report therefore calls for a commitment to long-term support for measurement, especially at high altitudes and in urban areas. More use should be made of wet-only collectors (which are not susceptible to contamination by gases and particulate matter) and frequent comparisons between institutions should be made to eliminate differences due to measurement protocols.

The authors, under the chairmanship of C. F. Barrett of the Warren Spring Laboratory, were unable to reach firm conclusions about recent trends in deposited sulphate, chiefly because of climatic variations from year to year, although nitrate concentrations do appear to have increased since 1957. Looking back further, to the beginning of the century, however, there is evidence that wet depositions of both sulphate and nitrate have increased in approximate agreement with emissions.

From the few sites at which daily analyses are made, the frequency distribution of deposition of acidity seems highly episodic, with typically 30 per cent of annual acidity being deposited in 5 or 6 days. Although acidity cannot be uniquely apportioned between anions, statistical correlations suggest that at most sites studied, sulphuric acid is responsible for about 70 per cent of acidity and nitric acid for 30 per cent. The largest predicted depositions of hydrogen ions occur in Cumbria and parts of Scotland, where levels are of the same order as parts of Scandinavia and North

several half serious ideas for technical fixes lately advanced. One scheme would add sulphuric acid to the atmosphere — an "artificial volcano" that would cool the Earth, offsetting the carbon dioxide-induced warming — but the price is estimated to be \$50,000 million per year. Another would establish mirrors in Earth orbit to increase sunlight available to high-latitude ocean waters; the increased light would permit the ocean biota to utilize the nutrient excess in these waters, increasing biological uptake of carbon. The capital cost for this venture is estimated very roughly at \$100,000 million.

Stephen Budiansky

\**Global Energy Futures and CO<sub>2</sub>-Induced Climate Change* (by D. Rose, M. Miller & C. Agnew) MIT Energy Laboratory Report No. 83-015, prepared for the Division of Policy Research and Analysis, NSF.

America. Dry deposition of sulphur, however, is a more local phenomenon related to local sources of sulphur dioxide.

Meanwhile, the European Economic community's Council of Ministers has been unable to reach agreement on a proposal from the Commission of limiting air pollution from industrial plant. The proposal, which is largely procedural, ran aground over an article on emission standards which entailed the eventual possible use of community-wide emission standards, to be introduced by a two-thirds majority. The Commission was prepared to drop the offending article, but the Netherlands objected: Britain and Ireland, in contrast, could not accept the use of such standards in any circumstances. A second much more specific Commission proposal on limiting air pollution from combustion plants, which would have important consequences for power stations, specifies targets for reductions in emissions from both old and new plant, but leaves the options open to governments on how it should be implemented. This proposal has not yet been formally discussed by the council, but is likely to generate an unusual amount of heat.

Tim Beardsley

## Scientific correspondence

Careful readers will have noted that correspondence is now published under two headings — the familiar general correspondence (see pages 103 and 104) and "Scientific Correspondence" (see pages 115 and 116). The objective is to provide a means by which readers can raise points of a rather technical character which are not provoked by articles or letters previously published (where "Matters Arising" remains appropriate).

Contributions to Scientific Correspondence will not usually be formally refereed. □