

Their ability simultaneously to observe source and background regions was pointed out. Several ideas on detection techniques such as liquid argon counters and gas scintillation detectors were also presented.

The use of laboratory accelerators in support of astronomical gamma-ray spectroscopy was also discussed. Such accelerators are needed for the measurement of the nuclear cross sections that are used in the theoretical calculations of gamma ray line emission from various astrophysical sites, and for the calibration of the detectors.

The symposium ended with a review of the space flight experiments presently planned for astrophysical gamma-ray spectroscopy. High resolution Ge spectrometers will be flown on NASA's ISEE-C and HEAO-C, and on the Air Force Satellite S78-1. The HEAO-C experiment, for example, to be launched in the summer of 1979, should have an order of magnitude better sensitivity than the Bell Telephone-Sandia experiment that discovered the 0.511 MeV line from the galactic centre. Solar gamma rays will be studied with NASA's Solar Maximum Mission during the upcoming maximum of solar activity. Of particular interest is the Gamma Ray Observatory which is presently being studied by NASA as a possible new start. This observatory provides the opportunity to fly an advanced instrument which could conduct truly second generation experiments in celestial gamma-ray spectroscopy. □

Climate and energy

from A. Henderson-Sellers

It has become increasingly evident over the past few years that formulation of national and global energy policies must be based on sound knowledge of climatic regimes and must include an assessment of the impact of power production and use on climatic stability. With these aims in mind the American Meteorological Society organised their conference on Climate and Energy*. The importance of climate to both production and consumption of energy is self evident. However, the timescales of the interactions and particularly the feedback effects from energy use into climatic regimes are not easily quantified.

The need for a suitable standard data base for energy planning was underlined by H. J. Snelling and G. J. Schofield (USAF Environmental Technical Applications Centre, Illinois), who described the inapplicability of the baseline figures for the fiscal year 1975

for the recently set USA Department of Defence energy reduction programme. The apparently arbitrary choice of 1975 as a baseline for energy conservation goals has led to serious problems in many areas. The authors convincingly established the almost hopeless task of certain areas experiencing either above average winter temperatures or below average summer temperatures (in 1975) in meeting their allotted goals. Planners should be made aware of the effective and sensible use of climatic norms in any conservation policy.

Climatologists hardly need to be told about the importance of their studies in the planning of domestic and industrial fuel supply policies. However, many of us at the conference expressed disquiet over our apparent inability to communicate successfully with politicians, economists and even the media and the public. Many practising meteorologists and climatologists genuinely believe that an understanding of the vagaries of climate are now of critical global importance. L. Machta (NOAA) suggested that by the turn of the century the increase in CO₂ concentration might act as the factor which most determined global energy usage.

The problem of the globally increasing CO₂ levels has been discussed for many years now. The argument centres around the substantial absorption of terrestrial infrared radiation by CO₂ in the atmosphere. This enhances the 'greenhouse effect' and leads to increased surface temperatures. There are many reasons to doubt the results of the numerous models generated over the past decade, and climatologists would be the first to identify the problems of successful prediction. Fluctuations in climate have occurred for millennia without anthropogenic intervention and indeed the whole global system may even remain stable in spite of our interference. Clearly, climate prediction cannot meet the necessary deadlines required by politicians and economists; but, though hesitating over firm values, the delegates were deeply concerned about the ever-increasing burden of CO₂ injected into the atmosphere. Far from considering that we are crying wolf about this well-known problem, Steve Schneider (NCAR) exhorted us to continue the search for greater understanding by reference to the modern parable: "The man dropping his wallet on the pavement at night would first of all search underneath the street lamps".

A simple increase in the size of the biosphere could be used to reduce atmospheric CO₂. Growing more trees would obviously imply permanent storage of the timber to restrict the

carbon recycling. Other (more exotic) suggestions are to artificially enhance plant nutrient loadings in water bodies so that the increased aquatic biomass would rapidly utilise carbon dioxide. Carbon dioxide can be removed from chimney effluent (that is, at the industrial source) but this is at present not economically feasible without government legislation or funding.

The reverse side of the 'impact of energy on climate' debate was developed in sessions designed to consider the effects of climatic regimes and climatic change on local and global energy demand patterns. The effect of climate on energy usage is at least two-fold. Analysis of patterns of present demand can only be tackled by consideration of climatic regimes and fluctuations. Obviously any development of alternative technologies depends critically on availability and comparative usefulness of different sources. To this end an interesting study on the shores of Lake Michigan which developed equipment to monitor the relative merits of wind and solar power was described by H. Moses (Division of Biomedical and Environmental Research, US Department of Energy, Washington).

The desperate need for energy conservation and also governmental policy encouraging both insulation and use of alternative sources of power was underlined by G. A. McKay (Atmospheric Environment Service, Toronto). The need for a detailed study of domestic energy consumption and especially the impact of climatic variations upon demand patterns was described by A. Henderson-Sellers (University of Liverpool), and the problems surrounding many of the basic equations used for energy predictions were dealt with by authors such as B. H. Bailey and J. W. Scott (State University, New York).

H. Landsberg drew the meeting's attention to the fact that many planners, designers and architects seemed to be unable or unwilling to use much of the information we had been discussing. Future policies, and particularly long range forecasting of both energy and climate, must be inextricably linked. □

Realities of fusion power

from R. Carruthers

A SUCCESSFUL fusion reactor calls for much more than the solution of plasma physics problems. This has long been recognised by the American Nuclear Society who have sponsored an important series of 'Topical Meetings on the Technology of Controlled Nuclear

*Held in Asheville, North Carolina, 8-12 May, 1978.

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