

# correspondence

## Selling the Sun

SIR,—Although man's existence depends, and has always depended, on nuclear fusion, the only functional system so far devised is some millions of miles removed and its major benefits are brought to us via photosynthesis. The "land issue" which should be faced is the fact that most surfaces are already covered by solar cells. These are called "green plants" and, at the molecular level, they can convert light energy into chemical energy with an efficiency of about 30%. Because most crops will not grow throughout the year or make best use of the available light, the realisable maximum is about 5% and in much agricultural practice may be of the order of only 0.1%. Nevertheless we are entirely dependent on this miserable conversion rate (and on past photosynthesis in the shape of fossil fuels). Is it then so far removed from reality and responsibility to suggest that we spend a little more than we do on increasing the effectiveness of biological solar energy conversion?

If terrestrial nuclear fusion becomes a reality it may make a massive contribution to our energy requirements. Photosynthesis (itself only one small item in the very large report on solar energy) does this already. Moreover, when all our oil and coal is spent it will have to serve as the major source of the elaborated carbon which we presently use unchanged or in the production of iron, plastics, fabrics and so on.

Money spent on nuclear fusion may be money well spent, but practical success is not guaranteed. Conversely, biological solar energy conversion has been with us for a long time. At the practical level it is hopelessly inefficient but there is no life without it. The room for improvement is immense. May it not even command a fraction of the expenditure on nuclear fusion?

Yours faithfully,

D. A. WALKER

Department of Botany,  
University of Sheffield,  
Sheffield, UK

## Spraying controversy

SIR,—In the article by David Spurgeon entitled "Spraying controversy revived" (May 20, page 184), it is suggested that emulsifiers used in insecticide sprays used for budworm control may be linked with Reye's syndrome.

If this is confirmed, the reference to the condition being first described in 1963 following the US Air Force's aerial defoliation in Thailand and Vietnam will need to be examined critically since none of the three herbicidal agents used for defoliation in Vietnam contained emulsifiers.

Details are available in the report of the National Academy of Sciences on the "Effects of herbicides in South Vietnam", published in 1974. It may be relevant to add that this very full report contains no reference to Reye's syndrome.

Yours faithfully,

J. D. FRYER

Weed Research Organisation,  
Yarnton,  
Oxford, UK

## Alternative refrigerants

SIR,—W. J. Megaw's letter (May 6, page 10) contributes to oversimplification concerning the fluorocarbon industry, and thus may mislead the incautious reader.

Refrigerants *leak* from refrigeration units. The causes are recognised engineering factors such as shaft seals, maintenance operations, permeation and eventual scrappage. Refrigerant half-life ranges from about 4 years for mobile and large fixed installations (non-hermetically sealed) to about 12 years for the hermetically-sealed units. The latter type is largely confined to small domestic units for sound engineering reasons.

Once a refrigerant cycle and capacity have been specified, the selection of refrigerant is made. R-22 is used where its physical, chemical and thermodynamic properties are suitable, but it is not well-suited for all uses. For this reason, R-22 accounts for only 30% of refrigerant sales rather than 50%, as suggested by Megaw. Forcing its use as a refrigerant across the board would result in major design and performance problems.

R-22 and R-12 can be manufactured in the same plant only if the plant was originally designed as a multi-purpose unit. Most fluorocarbon plants are dedicated to the manufacture of products derived from a common starting material. This approach provides the most efficient use of materials, energy and manpower, and results in the lowest-cost product.

Industry and government-supported research is under way to get the facts

in this environmental question. Recent technical developments stemming from stratospheric HCl measurements have forced further reductions in calculated ozone depletion. With these results, there is no reason at this time to implement Megaw's recommendation to sacrifice personal care products.

We all realise that our environmental decisions should be based on facts rather than emotion. Wrong "facts", however confidently presented, are not adequate.

Yours faithfully,

RICHARD B. WARD

Organic Chemicals Department,  
Dupont,  
Wilmington, Delaware 19898

## Water to the Dead Sea

SIR,—It has been suggested in your columns that both electric power (November 6, 1975, page 9) and water (February 12, 1976, page 444) could easily be generated from the flow of seawater into the valley of the Dead Sea (surface at -390 m). Besides using this head for turbine generated energy, both additional turbine and electrical energy could possibly be obtained from the osmotic volume flow across a permselective hyperfiltration membrane and from the so-called dialytic battery (*Science*, **191**, 557; 1976) respectively.

Limitations to the above methods should however, be kept in mind. These include: the loss of energy due to friction and volumetric flow due to evaporation; the practical need to operate seawater hyperfiltration at about 2½ times (or more) the osmotic pressure of the feed (that is, 72.5 bar or 725 m of water); the problems of concentration polarisation (salt build-up) at the membrane solution interface reducing the effective driving force; and the fact that brackish water is available near the Dead Sea and could possibly be demineralized at a lower price than seawater.

Thus, the proposed scheme to generate electric power and potable water for the arid Dead Sea region should be evaluated in light of the above limitations.

Yours faithfully,

GEORGES BELFORT

Human Environmental Sciences  
Program,  
School of Applied Science  
and Technology,  
Hebrew University,  
Jerusalem, Israel