REJECT HEAT — NOW IT'S A NECESSITY[1]

By George Sheard

There is no single solution to the industry's problems but, in my view, the use of reject heat from industry is one solution which deserves more attention than it has so far received. It is surprising in the circumstances that so little interest has been shown by growers and so little encouragement given by the Departments of Agriculture and Energy. Though there are many and difficult problems in relocating a proportion of the glasshouse area there is considerable potential to exploit quickly. Industry rejects very large quantities of heat mainly in cooling processes usually through the medium of air or water. The bulk of the heat is unfortunately low grade in the form of warm water but this is not invariably so. In some cases the temperature is high enough for the water to be used in conventional piped systems.

Four Big Sources

Electrical power generation, the chemical industry, petroleum refining and cement manufacture are four large sources of such heat. For the heat to be usable by a glasshouse enterprise the location must be suitable in respect of topography and climate and there must be no problems of particulate of gaseous pollution from the supplying process. Where the heat is low grade it cannot be economically transported over long distances and the glasshouses must be in close proximity to the source.

Condenser cooling water from power stations is by far the largest source of such heat. A modern 2000 megaWatts baseload power station discharges 3000 megaWatts of energy in the cooling towers - a quantity equivalent to the peak heat load from 3500 acres of glasshouses. In addition to the low temperature of much reject heat there can be problems in integrating a glasshouse operation where the supply of heat is large and constant and the demand from the glasshouses variable with season, weather and time of day. Generally it is only practicable to have systems which partially interact with the operation producing the reject heat.

From information which has been made public studies have been done on the feasibility of using reject heat from power generation, cement manufacture, alkali production, petroleum refining, malt whisky distilling, papermaking, paint manufacture and malting. Regrettably, only two projects appear to have got off the ground so far, one using power station cooling water, the other distillery cooling water.

The Central Electricity Generating Board began trials at Eggborough Power Station in the spring of 1976 to evaluate different methods of extracting heat from low temperature cooling water. These showed that air blast radiators were the best method and that it was possible to grow satisfactory crops of tomatoes using this source of heat.

The work at Eggborough was completed in the autumn of 1978 and led to the building of a ½-acre pilot scale commercial production unit at the Drax Power Station, the project being jointly financed by CEGB and Express Dairy Foods Ltd. This unit is now well through its first season.

'Whisky Heat'

The reject heat from malt whisky distilling comes from the still condensers which produce water at temperatures of 120 to 160F. The temperature of this cooling water is high enough to be used directly in conventional pipework. The Glen Garioch distillery at Old Meldrum, Aberdeen, began using its reject heat in 1976 in a ½-acre 5-span plastic structure producing tomatoes in the summer and forcing bulbs in the winter. Following satisfactory crops in 1977

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and 1978 it has been reported that the project is being extended.

Not all distilleries are in situations where glasshouses could be built and operated economically but a not inconsiderable number in the Inverness and Moray Firth areas, particularly those on the coastal plain have potential which could be developed.

These two projects tap into existing plant. Much more could be done more effectively if the possibility of linking in glasshouse production could be considered in the planning stage of new developments. At least three other projects have been taken to the point of detailed development studies.

The joint project between the Mobil Oil Co. and Van Heyningen Bros. at the Coryton refinery received wide publicity. A 10 acre site with high grade heat produced from a soda ash plant has been on offer in Cheshire and the use of reject heat from cement manufacture has been discussed on Humberside.

One should not discount any source of reject heat though the fuel supply and price position may stimulate industry to recover and re-use more reject energy within its own processes. In this respect cooling water from power stations has certain longer-term attractions.

Other countries have also been active in this field and it is worthwhile to review what they are doing. In France, work is in progress on at least three sites developing the use of reject heat from nuclear power stations, though the heat comes from the steam turbines and not the nuclear reactors. In this respect the work is similar to that of the CEGB in England. (Some readers may have seen the publicity film "Strawberries in the Snow" produced by Electricite de France which describes this work.) Heating is partly by pipe work and partly by plastic tubes laid on the ground. At St Laurent-des-Eaux heat pumps are used to upgrade the heat when the outside temperature is low.

Romania heats three quarters of its 1200ha of glass from industrial complexes based on a large central steam generating plant. The heat is supplied to the glasshouses in the form of pressurised water at 120 to 150C. It is not reject heat in the sense we use the term but the overall efficiency of these integrated industrial operations is potentially high.

The USA has projects at Browns Ferry and Minneapolis very similar to the Eggborough and Drax projects.

In Canada they are beginning to develop glasshouse production along the trunk gas pipeline in Alberta. These operations plan to use the gas turbine exhaust from gas pumping stations at points along the pipeline.

The Institute of Power Economy in Hungary is developing heat exchangers of a type that can provide dry cooling systems for power stations and heating for glasshouses. Two units have been built for development work each to operate ½ha of glass.

The Agrotherm project in West Germany is aiming to develop a power station cooling system using soil as the heat sink and to benefit agriculture and horticulture by soil warming. There are trials on four sites the largest at Neurath near Dusseldorf covering 7ha. The soil is heated by plastic pipes 60mm diameter buried in the soil 1m deep and 1.2m apart.

The Russians have made trials of a system in which warm water is flooded over a glasshouse roof. Indeed I saw such a system in Moscow in March 1978. Though the system worked it did not seem practicable on a commercial scale.

Energy supply and price will be a continuing problem against which the world will have to adjust by reducing its demand for non-renewable fossil fuels and by moving to alternative renewable energy sources. So far as the glasshouse industry is concerned there is considerable potential to lessen if not solve a large part of its energy problem by turning to the use of industrial reject heat. This will inevitably mean some progressive relocation of the industry. What is needed on the part of the grower is a determination to solve the energy problem and a clearly defined and enthusiastically implemented policy of positive encouragement from the Agricultural Departments.

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