Electricity, Gas and Other Fuels as Heating Agents

IN a paper read by Mr. A. H. Barker to the Institution of Electrical Engineers on December 1, an explanation was given of the conditions under which electrical power can be used competitively for the heating of buildings. It is well known that, reckoned on the heat unit basis alone, electricity is the most expensive of all the sources of heat in common use, and that comparatively, gas is at present not very far behind it. Since the heat in a gas company's therm equals 29·4 electric units, it follows that if gas cost 6*d*. per therm and electricity 0·5*d*. per unit, the cost of the crude heat per therm delivered by the gas company would be 6*d*. and by the electric company 14·7*d*. In a few years' time we hope that more companies will be supplying at these cheap rates. If the thermal electric storage were employed the price of the electric heat would be reduced by about forty per cent. With oil at 80*s*. a ton and coke at 40*s*. a ton, the costs would be 2·25*d*. and 1·64*d*. a therm respectively. Looking merely at the costs of the 'crude' heat, the solid fuels are much cheaper.

The most fundamental difference between gas and electric heat is that with the former it is purified fuel which is transported to the spot where the heat is required, while with the latter it is energy only. There are three points arising from this. The street main is much larger and more difficult to accommodate with gas than with electricity but the house-pipes for gas are smaller and cheaper. In order to convert the gas energy into heat, it has to undergo the process of combustion with the disadvantages of high temperature and waste products of combustion. The use of gas causes less actual destruction of fuel than electricity and the heat from it is therefore cheaper. Gas is in fact crude fuel which has had all the ashes and smoke purified out of it at the sacrifice of the manufacturing costs and about twenty per cent of the energy of the crude fuel. Electricity carries the purification a stage further. In its manufacture, everything, including all the labour, is purified out of the fuel but there is a loss of about twenty per cent of the energy in the mains. There are obviously cases, where so far as its usefulness is concerned, this further stage of purification is a pure waste of money, just as it is a waste of money to soften water needed for sanitary fittings.

In Mr. Barker's opinion, gas and electric supply have each their own sphere of usefulness, in which one is either economically or functionally superior to the other. There is only a small area of supply in which reasonable competition is legitimate. Both industries ought to be amalgamated, in their own and in the public interest. It is very difficult to assess the money value of their relative advantages and disadvantages in each particular case.

Apart from its cost, electrical energy is almost an ideal means for room warming. By its agency, pure heat can be delivered through light and flexible wires in any quantity, at any temperature and in any desired form to any particular spot. Turning on and off involves nothing but a mechanical motion of a switch and this can be readily done automatically by a simple and trustworthy form of thermostat. The use of any other fuel gives, along with the heat, products of combustion of a more or less deleterious nature. It is only in very special cases that heat derived from the combustion of fuels can be employed without the use of chimneys.

Gas possesses the advantage that it can be exactly regulated to requirements. It can be conveniently stored so that a sudden overload need not affect the supply. Breakdown is less probable than with the more complicated electrical plant. In some cases when combustion is effected completely, the products are innocuous and so can be allowed to mix with the air of the building and so secure—like the electrical fire—an efficiency of one hundred per cent. The drawbacks are that gas needs to be ignited and supplied with air before the heat can be developed. It has an objectionable smell and is dangerous if it escapes or is incompletely burnt.

The advantages of oil are that it is fluid and so can be pumped with little smell or trouble into a tank through a pipe-line. It is much easier to ignite, to regulate and to extinguish than coke, though more difficult than gas. It is very clean in operation, and when properly burnt highly efficient. Owing to the high degree of the combustibility of oil, there is a good deal of potential danger attached to it. It is apt also to give off smoke and odorous fumes. The advantages and disadvantages of coke and other solid fuels are well known. For example, they will allow any sort of combustible material to be destroyed in the furnace. It is probably the most economical form of heating but it involves greater labour than any other fuel. It produces dust, is dirty to deliver and clumsy to handle.

Mr. Barker deals exclusively with the cost of the fuel and the labour involved in handling it. When the heating required is intermittent, both electrical and gas heating have advantages over the other fuels.

Mesolithic Age in Britain*

IN 1926 the Royal Anthropological Institute held an exhibition illustrating the microlithic industries of Britain, to which all who were then known to be interested and engaged in forming collections of implements of this phase of the Stone Age were asked to contribute. The mesolithic period had been somewhat neglected by British archæologists; and it is probable that it came as a surprise, even in archæological circles, to find how considerable was the amount of material which it had been possible to get together and the increase in the interest taken during the early years following the War in these remarkable products of man's skill and ingenuity.

In the period which has elapsed since that exhibition was held, further progress has been made in the study of the mesolithic age, and the time was fully ripe for a detailed discussion of the position of microlithic industries in relation to preceding and succeeding cultures. The opportunity for such discussion was afforded by a series of papers in the programme of Section H (Anthropology) when the

*Based on certain papers read before Section H (Anthropology) of the British Association at York, September 6, 1932.

British Association met at York last summer. The conditions were exceptionally propitious, as not only were there within reach of York sites of sandy heath typical of the geographical environment preferred by Tardenoisian man, upon which, moreover, numerous finds of implements had been made, but also the fact that Mr. J. G. D. Clark was to open the session with a paper on the mesolithic age in Britain ensured that the otherwise preponderating attention to be given to the north of England in this series of communications would be placed in proper perspective.

The advances which have been made in the study of the typology of mesolithic implements now make it possible to work out the geographical distribution of characteristic forms with a relative certainty, if not with an absolute precision, while a number of pregnant suggestions emerges as to their derivation and development. Thus Mr. Clark holds that, while the Upper Palæolithic industries of Britain already showed microlithic tendencies, the Tardenois culture is to be regarded as intrusive in both its first and second phases, and late Tardenois, though in all probability a local development in its British manifestation—the 'trapezoid' implement is said to be peculiar to Britain—also has indications of continental influence. Thus in the Pennines the 'broad blade' industry, the non-geometric Early Tardenois industry, is certainly of continental derivation, while the Middle Tardenois, which extended as far as the Isle of Man, points to Belgium. At the same time, the view thus taken of late Aurignacian industries must be kept in mind in considering sites which show a sequence of cultures, such as those described by Mr. A. L. Armstrong.

The study of types leads Mr. Clark to divide Britain into two provinces, of which Province *A* is characterised by the absence of the tranchet axe or pick, while the microliths are present both in the early non-geometric forms and in the later geometric forms, some of them of extremely small size. In Province *B*, the south-east of England, on the other hand, the tranchet axe is found, but the place of the geometric forms of Tardenois industry is taken by the still surviving non-geometric forms.

In the working out of the sequence and relation of the phases of Tardenois cultures, the investigations of Mr. F. Buckley in the Pennine chain are especially significant, although the whole chain has not been covered and his conclusions are drawn only from certain selected sites, such as Standedge Ridge, Yorks, where the whole chain narrows down to a single ridge, along which mesolithic man must have passed in avoiding the valleys. Various mesolithic sites under the peat have been excavated. These sites contain the relics of two distinct peoples or races of Tardenois folk. Of these one is known as the folk of the 'broad blade' industry, the other as the people of the 'narrow blade' industry. The implements of the former are predominantly of the non-geometric type and include many pointed blades, while among those of the latter are numerous small geometric tools. This people used open-air encampments and wandered freely over the hills; but the 'broad blade' folk travelled along the watershed ridge and erected huts or wigwams on their camping sites. The hearths have yielded wood remains, giving some data as to tree distribution in mesolithic times.

An important contribution to the discussion of mesolithic problems, comprehensive in its view, was made by Mr. A. L. Armstrong's account of his investigation of the Tardenois and pre-Tardenois cultures of north Lincolnshire in the light of evidence afforded by a number of sites in that area. Here a series of stratified sections and occupied sites exhibits a continuous sequence of industries, embracing the Upper Palæolithic and the whole of the Mesolithic periods. Mr. Armstrong has recently discovered Aurignacian flint implements in glacial gravels at Hardwick Hill, east of the Trent. These are heavily rolled, owing, it is suggested, to the wave action of an estuary or glacial lake, and point to the existence here of palæolithic man before the last glaciation—possibly a band of hunters who had penetrated the swamps and taken up their residence on the dry uplands of the Cliff Range and, probably, also on the Wolds. They appear to have inhabited this region through the last phases of the glacial epoch and to have remained until the appearance of mesolithic peoples, the Azilian and Tardenois. The latter eventually dominated Lincolnshire, according to the indications of a number of stratified sites.

Of these sites the earliest is a late-Developed Aurignacian (Creswellian) station, discovered by Mrs. E. H. Rudkin, and excavated in February last, on the western escarpment of the Lincolnshire cliff above Willoughton. At Sheffield's Hill, near Scunthorpe, a similar occupation site, but of later date, gives evidence of the final phase of the developed Aurignacian, upon which early Tardenoisian was imposed. At Risby Warren, Scunthorpe, where systematic researches have been carried out for eleven years, there is stratified evidence of occupation levels ranging from developed Aurignacian, which is quite free from Tardenois influence, to the earliest neolithic, full neolithic and bronze ages. The Tardenois culture is represented by several horizons and can be classified broadly as early and late. This site, Mr. Armstrong claims, in virtue of its abundance of stratified material and its numerous occupation zones, representing the whole of the Tardenois period, is to be regarded as the type station of Tardenois culture in England.

University and Educational Intelligence

WALES.—The University Court at its meeting on December 15 decided to award the degree of D.Sc. *honoris causa* to Prof. Francis Ernest Lloyd, professor of botany in McGill University, and Prof. Robert Robinson, Waynflete professor of organic chemistry in the University of Oxford.

THE Institute of Sociology, Le Play House, 65 Belgrave Road, London, S.W.1, has now been incorporated as a company limited by guarantee. This is the final step in a scheme for permanently establishing and endowing the Institute, which was initiated in 1920 through the generosity of the late Mr. and Mrs. Branford. Under an order of the Chancery Court, the whole of Mr. Victor Branford's estate, subject to the temporary reservation of a portion for the benefit of relatives, passes to the Institute. The present officers of the Institute are Dr. R. R. Marett (president), Rector of Exeter College, Oxford; Mr. C. H. Rigg (honorary treasurer), and Mr. A. J. Waldegrave (chairman of council).