

show that they represented a real advance for mankind instead of merely examination examples; the exaggerated emphasis on plane deductive geometry will give place to a better understanding of the spirit of mathematics. Judging from the school syllabuses, one would imagine that every mathematician was continually using logarithm tables, whereas the present tendency is more and more to use machines both in commerce and in research laboratories.

It is not possible, however, to estimate correctly the importance of mathematics if it is only considered in relation to the physical sciences. Mathematics is very closely related to both the natural and the social sciences, although so far in history the main impetus for its development has come from the former; this is mainly because society hitherto has been much more interested in the natural sciences because of their immediate importance in technology. Nevertheless, statistics owes its development to the social sciences. Even at quite an elementary level, a proper treatment of averages brings in ideas which are not common to other parts of mathematics and which are important in the world to-day. During the War, increasing use has been made of the methods of pictorial statistics in order to make numerical results more understandable.

Lastly, it should never be considered that greater emphasis on these broader aspects of mathematics and science is only of value to the 'man in the street' and not to the expert. To-day we are meeting all kinds of interconnexions between apparently unconnected parts of science, and the person who specializes on one narrow section without appreciating its relation to the whole of modern knowledge is apt to take longer in his work and not see its true significance when completed.

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### Area Heating

HAVING been responsible for many large district heating plants on the Continent, I have read with great interest the article "Area Heating" in NATURE of October 30. It is often said that in Great Britain, with its mild climate, there is no need for district heating. The ever-increasing number of central heating plants, however, shows the urgent demand for centralized, labour-saving heat supply; and by the adoption of district heating, relatively more coal can be saved in Britain than on the Continent. By co-ordination of heat and electric-power generation, it will be possible to reduce the present consumption of coal for heat and electric power generation in towns and cities more than by half, and to eliminate entirely the smoke nuisance with all its evil effects.

The co-ordination of heat and electric power generation is, however, a more complicated and difficult matter than it appears to be from Dr. Hughes's article. The thermal efficiency of electric power generation from steam greatly depends upon the vacuum, and the cooling water is heated in the condenser to a temperature of 85°-100° F. only, which is of no use for heating purposes. Higher temperatures can only be attained by an increase of the back-pressure, and this is accompanied by a corresponding increase in steam consumption for electric power generation. A further difficulty is that

the hourly, daily and seasonal variations of the heat and electric power loads do not coincide. The daily variation can be overcome, as Dr. Hughes rightly pointed out, by hot-water storage, but this method is not applicable for seasonal variations.

According to Dr. Hughes, after the War new electric power stations will be required. Should it be the case, it would be better, from the point of view of district heating, to install the new generating capacity in existing stations as back pressure sets for heat and electric power generation. This will give a much greater flexibility for development of district heating than new large heat electric stations.

The suggestion of Dr. Hughes to burn the coal in new boiler stations located on the rim of large centres of population and to transmit the steam to turbo-generators located at the centre of gravity, disposing of the heat in the surrounding domestic and industrial areas, is probably due to a misapprehension. In my paper before the Institution of Heating and Ventilating Engineers<sup>1</sup>, I showed the possibility of electric power generation in two, or even three, pressure stages when co-ordinated with district heating. In the primary station, steam of high pressure is used for electric power generation with back pressure sets, and the steam of, say, 200 lb. per sq. in. abs. is transmitted to the older station to feed the back pressure sets for electric power and heat supply. Thus the boiler house can be eliminated and generation of electric power and heat is made possible inside a town without the burning of coal. The steam from the primary station must, of course, be delivered to the secondary station with sufficient superheat. Therefore, the steam main must be carefully insulated to reduce the loss of the valuable superheat as much as possible. But even mains carrying low-pressure steam or hot water and accumulators have to be carried out with good insulation. Owing to the increased transmitting capacity, the percentage of heat losses of large mains is very small. The actual heat losses and their costs, however, are practically proportional to the area of the pipe surface. The economic thickness of the insulation has, of course, to be calculated for every scheme, but it has generally been found that good insulation pays.

The saving in fuel was the main argument for the introduction of district heating in the U.S.S.R. That country is now leading in the development of district heating, and the new electric power stations are already predominantly built for co-ordinated heat and electric power supply.

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<sup>1</sup> "Experience with District Heating in Europe and U.S.A. and its further Development". *J. Inst. Heat. and Vent. Eng.* (November 1935).

I AM particularly glad that Mr. Margolis has been prompted to publish more relevant information on area heating, and to correct some of my speculations based on the technical data already available. I certainly did not intend to convey the idea that area heating could be effected from existing plant. I agree that the location of boilers at a distance from the generating station is probably uneconomic, but if the advantages to a community are sufficiently recognized, maybe the community might sanction the excessive cost.

L. E. C. HUGHES.