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Electric Supply in Great Britain.

UNTIL the details of the Government electric supply scheme for Great Britain outlined by Mr. Baldwin on January 15 are published, it is only possible to discuss the scheme in a general way. It may be useful, however, to give a brief survey of the conditions affecting electric supply in Britain. The proposals are of national interest, affecting directly not only the electrical industry but also the many industries for which electric power is a necessity. They also affect every one who uses or in the future may use electricity for domestic purposes.

Situated all over the country are 584 public supply stations. A few of these are large and highly efficient, but several are getting antiquated. They are operated by private companies, municipalities and "joint authorities" in accordance with the Electric Lighting Act of 1919. Some of these are authorised to supply electricity in bulk, and these will retain their powers. After the electricity is generated it is transmitted to distributing stations, where the business of the engineers is to make arrangements for supplying consumers with electric power and light. The scheme is to eliminate gradually the inefficient generating stations and convert them into distributing stations. They will purchase their electricity in bulk from a central board, which will own a huge distributing network of mains. This board will purchase its electricity from a selected number of existing generating stations, and after paying the small expenses of management and the interest and sinking fund on its network, will apply any surplus to the cheapening of the cost to the consumer.

The scheme is not exactly novel, as a somewhat similar one was suggested for Great Britain and discussed in the electrical press last year. It seems, however, to have been studied in detail by the Electricity Commissioners, who approve of it. It will be useful, therefore, to consider the beginnings of electric supply in Great Britain and to discuss some of the problems that will want careful consideration. There will be no Government subsidy, but the interest on the capital required to purchase the transmitting mains and to pay for the cost of their erection will be guaranteed by the Government under the Trade Facilities Act.

The evolution of the method of supplying electricity over considerable distances was started by Ferranti about forty years ago. He designed a station at Deptford for generating electrical energy at 10,000 volts and transmitting it to substations in London, where it was transformed down to lower pressures and distributed to consumers. The site was chosen in a place where there was abundant water for condensing purposes and where coal was cheap owing to the low costs of transport. The late Lord Crawford was very enthusiastic over the scheme and was one of its strongest supporters. It needed great courage and great faith in science in those days to undertake such an experiment. It is interesting to remember that it is this station which supplies the power required by the Southern Railway to work its electrified sections. Ferranti is universally recognised as the pioneer of modern electric supply. The Government legislation of this period made electric supply very difficult. London was divided up into small areas, each of which was to be supplied by two

companies, one using direct current and the other alternating current, the idea being that the competition between the two would tend to cheapen the supply. Under such conditions, it is surprising that any company survived, seeing that security of tenure was only given for a limited number of years.

In 1919, only seven years ago, the Government again introduced legislation affecting the industry. The country was divided up for electrical purposes into a number of districts, each of which was practically autonomous, and powers were given for the erection and working of large generating stations by joint authorities. The new scheme considers that England is not too large to be considered as a single unit, the generating, transmitting and distributing parts of the industry being kept quite distinct. It has been very cleverly arranged that the new scheme will gradually come into operation with the minimum disturbance of existing arrangements, and yet, in ten or fifteen years' time, the great bulk of the public who use electricity will be supplied at very much cheaper rates.

At first sight, we picture this national system of transmitting lines as extending from Land's End to Thurso, and from Glasgow to Newcastle, Birmingham and London. To diminish the cost of transmission, if not 220,000 at least 110,000 volts must be used. A little consideration, however, will show that the cost of the mains required in this case would be altogether prohibitive. Still we consider that in ten years' time the length of the lines necessary to link up all the centres of supply will be at least 2000 miles and the cost of overhead mains would be at least 6,000,000*l*. It has also to be remembered that there will be a heavy additional expenditure at the distributing end of the mains due to the rotary converters or mercury arc rectifiers which would probably be used to lower the pressures and convert the alternating current supplied into direct current.

It will be seen that a national transmission network can only be erected at a very great capital cost, and interest, depreciation and maintenance will be very heavy items. But we think that, provided the scheme is not rushed unduly but allowed to develop gradually, it is a good and sound commercial proposition. In any case, owing to the Government guarantee, we think that the requisite capital will easily be obtained. It has been suggested that it may be possible in the future to transmit electric power through the ether without transmission cables at all. With our present knowledge of science, however, this suggestion, like the corresponding one of obtaining energy from the atom, need not be seriously considered for many years to come.

In our opinion, Mr. Baldwin perhaps laid unnecessary stress on the standardisation of the frequency. Most electricians agree that 50 should be the standard frequency and that every new station should have this frequency, but there is no urgent necessity for scrapping the existing generators and apparatus which work at other frequencies. It is a very simple operation to link two networks together by suitable synchronous motor-generator sets so that power can be transformed from one to the other quite easily.

This national network will provide a large number of problems for mathematical engineers. In Great Britain, hitherto, it has been permissible to assume that the capacity and inductance of the mains can be supposed to be concentrated at particular points of the mains. In the future, this assumption will seldom be admissible as the networks will be large and hyperbolic sines and cosines will have to be used in making the requisite calculations. Again it will not be sufficient to assume that the most economical site is the centre of gravity of the load. Lengthy calculations will have to be made, and the problem of finding which site is the best will have to be investigated much more minutely in the future than in the past. Competent mathematicians should be in great demand.

Unfortunately, there is not yet a 1,000,000 volt testing transformer at the National Physical Laboratory for testing the high voltage insulators which will have to be used. Progress in this direction should be accelerated. The physics of the brush discharges, generally called the corona, which appear sometimes on high tension mains, have been thoroughly investigated in the United States.

Mr. Chattock, in his presidential address to the Institution of Electrical Engineers, pointed out that it would be very difficult to supply rural districts at a reasonable rate by tapping the high tension mains directly, as this is always a costly process. The connexions would have to be made at well-defined centres, from which light overhead wires carrying currents at low pressures would radiate in all directions. The present high price of wiring cottages in rural England for the electric light is due to the very stringent regulations under which wiring contractors have to work. On the Continent, the cost is only about a third or a quarter of what it is in England. There is a considerable margin, therefore, for reducing the price of wiring by lowering the pressure of supply sufficiently so that much less stringent regulations could be used.

We hope that something will be said in the promised Bill about electrifying the railways and equipping every coal mine in the country with complete electrical plant for getting the coal and for pumping and ventilating. Expenditure of this kind is immediately remunerative, and the Government guarantee would help to foster what the Americans call "public utility" services.

One great advantage of interlinking supply stations is that the supply of reserve plant will be largely reduced. The Electricity Commissioners have stated that 68 per cent. of the generating plant in Great Britain is normally idle. We were glad that the Prime Minister in his speech laid stress on the necessity of educating the public to the many domestic uses to which electricity can be put. The demand is certain to increase as the points of supply are multiplied and the price per unit reduced. It can nearly always be used economically for cooking and in many cases for heating. If the price of electricity be sufficiently reduced, chimneys will be a relic of barbarism. This Bill should give electrical engineers a great opportunity of showing how greatly they have benefited by the scientific and technical researches carried out since the War. The maximum water power available to us is only about a tenth that required for our industrial needs. Looked at from the electrical point of view, Britain is a very compact country with plenty of fuel available for many years to come. We look to our engineers to control the forces of Nature to further the welfare of the nation.