Fuel Research.

33. There is one other branch of work affecting the primary industries of mining which appears to be of great importance to the secondary industries and to the nation as a whole: I refer to the study of the natural fuels of New Zealand and of possible synthetic fuels. Some work is already going on in this field, notably by the Government Analyst on briquetting, and at Canterbury College, Christchurch; but there is a real necessity for better knowledge, not only of the extent but even more of the characteristics of New Zealand's fuel resources, which the interest shown in the development of electric power is tending to obscure. It must be remembered that the expenditure of heat in industry is, on the average, much higher than the expenditure of power, and that electricity is an expensive source of heat, which is not economically justified unless the factory is putting out products of very high grade, or requires the application of heat under very accurate control or in closely defined areas. This is one reason why Norway, though possessed of cheap electric power, has not developed into a great manufacturing country: she is destitute of fuel. New Zealand, on the other hand, has considerable fuel resources, for which there must always be a demand in industrial operations. Her fuels, broadly speaking, have certain advantages, such as relative freedom from ash and sulphur; but they also have disadvantages, such as friability and a suitability less than the best for steam-raising. A complete chemical and physical survey of the coal-seams needs to be made, with the assistance of the owner, and in accordance with the procedure worked out by the Fuel Research Station attached to the Department of Science and Industrial Research at Home. The results of this survey will give indications as to the coals which should first be studied with a view to more economical use and better treatment. In this my Department at Home is willing and anxious to assist. They would place the resources of the Fuel Research Station at the disposal of the New Zealand Government for large-scale experiments on consignments of coal in return for actual out-of-pocket expenses, and thus save the Dominion from the expense of erecting a large station. But there should be facilities here for the necessary preliminary work to be carried on in close agreement with the methods successfully laid down at Home. It is now certain that it will be possible to produce by suitable treatment fuel, oils, and spirits from coal distilled at temperatures lower than those used in gasworks or coke-ovens, with the concurrent production of a soft and smokeless coke that burns as easily in an open grate as raw coal. This work done at the Fuel Research Station needs repeating and probably modifying to suit New Zealand fuels, for any process that would help to release the Dominion from entire dependence on imported liquid fuels is important, not only economically but also from the point of view of defence.

34. Accordingly I recommend that a committee be set up under the research organization to prepare a plan for the systematic study of the Dominion fuel resources in consultation with my Department at Home; that it prepare estimates of cost for submission to the central organization, and that meantime a young man of science should be attached as soon as possible to the staff of the Fuel Research Station at Greenwich for a period of years in order to acquaint himself with the principles and details of our methods.*

IV. The Secondary Industries.

35. I have taken great care to try and obtain a broad general view of the secondary industries of New Zealand and to meet representative manufacturers in each centre I have visited. All are agreed that more science is needed, and some are taking steps to appoint scientific men in their works, as others, and the more progressive, have already done. It is natural that the industrialists should be rather vague as to the best means of attaining the end they desire, for the majority of factories are too small to make it possible for them to face the expense of the smallest scientific organization in their works. It is noticeable that the Statistical Report on Factory Production, 1925 (page 23), shows over 80 per cent. of the factories in the Dominion employ less than twenty-one workers apiece, while there seems to be a tendency for the proportion of small works to increase—though the tendency is far less marked than in Australia. Everywhere I have pointed out to manufacturers that the State could not possibly employ a staff adequate to solve all the manifold problems arising in the course of production in the many industries now carried on, and that even a staff adequate in numbers and scientific qualifications could not hope to solve these difficulties unless they were actually attached to the works. Here, as elsewhere, a choice must be made of the more urgent problems, and considerations both of economy and of man-power suggest that the firms in each industry should combine to finance, with some Government assistance in suitable cases, the conduct of research work on one or more problems of common interest to them all. In the case of the bigger industries co-operative research associations might be formed on a model similar to that adopted in the Old Country, while in the case of smaller and poorer industries a research worker might be selected by a suitable professor and directed to work at selected problems under his guidance. But either plan would necessitate the free access to the works of all contributors for the scientific worker, and full facilities for the making of works experiments. This suggestion was received with considerable sympathy in all quarters, especially when I emphasized the importance of initiative and individual effort for successful business, and the danger a State-controlled scheme would bring with it, of destroying these virtues just in proportion as it was successful. A relatively small sum of money placed at the disposal of the new central organization, to be expended in grants under proper conditions, to co-operative efforts of the kind indicated, would produce the maximum effect and would have all the advantages of an experiment which could be abandoned if it

* I understand that an 1851 Exhibition Scholar is now in England who might be suitable for this duty on the expiry of his scholarship.