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Coal Utilisation and Research.

THE Report of the Royal Commission on the Coal Industry, some aspects of which were presented by Prof. Henry Louis in an article in NATURE of March 20, is still under consideration and discussion. It is now generally understood that the report refuses to prescribe for the sick man any tonic or pill with the pleasing promise of a lightning cure, but insists on the necessity for a systematic application of the principles of economic hygiene to daily life as the primary essential to recovery. Even such labels as low-temperature carbonisation and electrification on the medicine bottles are not held to guarantee a cure. It is not that the spirit of the Commission has been cautious, conservative, or narrow. Its report is, indeed, quite remarkable for breadth of view, and for what appears to be a well-balanced consideration of the very numerous and varied factors which are operative in the problem presented. These characteristics can certainly be claimed for Chaps. iii. and iv. on utilisation of coal, and research, with which the present writer is more immediately concerned.

The position as regards actual and potential methods of consuming coal is admirably stated in Chap. iii., while Chap. iv. deals with the existing provision for research connected with coal, particularly 'organised' research, and with proposals for extending that provision. Under pre-treatment of coal, the adoption in the eighteenth century by British ironmasters of the use of coke in their blast furnaces is given the first place, initiating an industry which now employs 40,000,000*l.* of capital, and yields not only coke, but also tar, sulphate, benzole, and surplus gas. The position of the parallel carbonisation process, that of the gasworks, is indicated by the statement that the capital now engaged in it is 160,000,000*l.*—not very far short of the capital of the mining industry itself. Yet these two industries, in which coal is systematically treated before use, represent only some 37 million tons, while the coal consumed in its raw state amounts to 147 million tons, and the statement is made that, while for some purposes, such as large boiler plants, it is doubtful whether it would be economical to carbonise the coal before burning it, there is no doubt that a large proportion of the 147 million tons is consumed in a very wasteful manner.

The consideration of pollution of the atmosphere by smoke, the possibility of supplying oil from coal, and the position of low-temperature carbonisation, follow naturally with some reference to the use of pulverised solid fuel for firing furnaces and of the so-called colloidal fuel, that is, finely divided coal mixed with fuel oil. There is probably no one remedy for the smoke nuisance

which would compare in importance with the use of some form of smokeless solid fuel in the domestic grate, and the interest in low-temperature carbonisation is stimulated by that idea. But the pronouncement of the Commission based upon a memorandum furnished by Dr. Lander is inevitably very guarded:

"We have given close attention to the question of low-temperature carbonisation, but we can find no evidence that the system has yet been anywhere established on a commercial scale for a period sufficiently long to enable the claims that are made on its behalf to be fully tested."

It is not that carbonisation at a low temperature is a technically unrealisable process, since it is in essence a reversion to older practice. The difficulties are quantitative and commercial, and the problem is to overcome those difficulties in a fashion quite opposite to that adopted by the gas industry, which has developed by carbonising at high temperature and obtaining the maximum possible yield of gas—the carbonisation product which displays a greatly enhanced thermal efficiency in use with a correspondingly increased monetary value. Research on this subject is likely to have to go far back into the properties of coal itself, and the possible means of utilising and modifying such properties so as to arrive at a cheap and rapid process which will give the results required without incurring excessive costs in the installation of plant, and the working of the process itself. Encouragement is forthcoming from demands of different origin, since apart from all question of smoke abatement there is the national need for home supplies of liquid fuel, including motor spirit, and the desirability of finding some sort of use for low-grade coals, at present of no commercial value. If it were possible to subject to this process the bulk of the 147 million tons of coal now consumed in the raw state, the greater part at least of present British requirements of oil could be supplied from home sources, instead of being imported from abroad. Nor is the Commission pessimistic. ". . . the evidence we have taken has given us the impression that we may be within measurable distance of a solution of both the technical and commercial problems that arise. We recommend that the Government should give sympathetic consideration to any proposals of the Fuel Research Board for the further investigation of the process on a commercial scale."

There is no doubt that here a great difficulty presents itself. So far as concerns the scientific and technical research to which reference has been made above, into the properties of coal itself, the path is comparatively smooth, but the solution of what are grouped under the term of 'Commercial problems' is another matter. The Fuel Research Board has already gone so far as to

undertake, without charge, the testing-out of low-temperature carbonisation plants on a commercial scale in order to obtain reliable information and to give it to those concerned. This is, as the writer can say from experience, no easy matter to carry through in such a way as to obtain trustworthy results, but it is practicable. The commercial interpretation of such results in a form to have any general application is, however, much more difficult, and the Fuel Research Board has so far held its hand at that stage. If, too, the financial backing of pioneering industrial adventures in this field is to be undertaken, it will have to be with eyes open to the very large costs which are only too easily incurred in such work without tangible results.

The Commission lays great stress on the co-ordination of coal-using industries, and its report should go far to counteract the mistaken ideas only too easily derived from the ill-balanced report of the Coal Conservation Committee issued in 1918. The Commission says:

"It has been strongly impressed upon us as the outcome of our enquiries that it is an error to suppose that the only, or even the principal, object to be aimed at in this connexion is the most economical method of producing electricity. The object to be aimed at is the most economical and efficient way of utilising the energy embodied in the coal. The question is not co-ordination, as is often supposed, of two industries—coal and electricity—but of several—coal, electricity, gas, oil, chemical products, blast furnaces, coke ovens, etc. Two or more methods, dealing with two, three, or more of these, would be used simultaneously in combination, one feeding the other. The point of importance is, that no obstacles, whether of State regulation or industrial organisation, should be placed in the way of the development of such combinations in whatever manner engineering and chemical skill and the economic conditions may indicate as the most suitable."

Arising out of such considerations, the Commission "venture to suggest for consideration the formation of a Standing Conference composed perhaps of the Chairman and other representatives of those bodies we have mentioned," these being the Coal Commissioners (whose appointment is recommended elsewhere), the National Gas Council, and the Electricity Commissioners. Its primary task would be to ensure that while a healthy competition should be maintained where it was legitimate between these various interests, their energies should be developed in a manner complementary in the main to each other. Moreover, it is proposed that a survey, which from the nature of the case should be a continuous process undertaken by a body of a permanent character, should be made of the heat, light, and power requirements of the various industries of the country as a whole.

The Commission has concerned itself seriously with research into matters connected with coal as of primary

importance, reviewing the present provision and suggesting developments. In all such schemes one outstanding point is often overlooked. If an industry is to reap the full value of research work done within it or on its behalf, it is essential that in the executive ranks of the industry itself, in its direction and management, there should be men willing and able to give effect to the results obtained and discoveries made. For this reason, the conversion of an industry from the empirical to the scientific is a gradual process, and is not to be done simply by the attachment of a research staff (with the formulation of a programme) to an industry which remains at heart unconvinced of the value of scientific work. The following sentence in the report is no doubt inspired by some such conviction: "It is also essential that the industry as a whole should become imbued with the spirit of science in order that it may utilise to the fullest extent the results of modern scientific developments." Another point of importance recognised is that the existing supply of research workers for the fuel industry is quite inadequate to meet such demands as are contemplated, and the recommendation is made "that the Colliery Owners' Research Association encourage the scientific training of students for the work of the Research Association, and for the survey, and that for these purposes it be authorised to provide scholarships and arrange with universities for suitable courses."

The field of research surveyed is a large one, including as it does occurrence and constitution of coal, coal winning, and coal utilisation, each with its subdivisions, hygiene and safety being given prominence in the coal-winning section. Work already in hand by the Fuel Research Board, the Safety in Mines Research Board, the Geological Survey, the Colliery Owners' Research Association, and the National Federation of Iron and Steel Manufacturers, is described, as also that carried out in conjunction with the University of Leeds by the Gas Investigation Committee of the Institution of Gas Engineers and by the National Benzole Association. It is noted that the Bergius process for the 'liquefaction' of coal and synthetic methods for the conversion of water-gas mixed with additional hydrogen into motor-spirit are receiving attention.

Then comes a section on the future of research work, which begins with an expression of opinion that the attitude of the British Coal Owners' Research Association (as indicated by Mr. Evan Williams, President of the Mining Association, in evidence) "indicates an insufficient appreciation of the importance of this question," and further emphatic statements, such as, "While research alone will not overcome the difficulties from which the Industry is now suffering [a qualification which the writer is glad to see made] we feel

strongly that the steady and continuous investigation into all pertinent problems is essential if the industry is to prosper and to provide good wages and conditions for its workers."

Recommendation is made that the British Colliery Owners' Research Association be rapidly expanded, and that the managing council of the Association should be composed of representatives of the owners, managers, mining engineers, workers in the industry, the Mines Department, and the Department of Scientific and Industrial Research. A sum of 100,000*l.* should be provided for the establishment of a headquarters, a highly qualified director of research appointed, and such continuity as will attract the right men for the staff and render possible the obtaining of useful results in work which is necessarily slow, should be secured by guaranteeing an income averaging 40,000-50,000*l.* per annum for at least seven years. The funds are to be provided partly by the owners and partly by the Department of Scientific and Industrial Research, which is to take the initiative in organising and developing the Research Association. According to this scheme there would then be three large organisations, each dealing with one aspect of the coal problem: (a) The Colliery Owners' Research Association, expanded as indicated above, (b) The Safety in Mines Research Board, and (c) The Fuel Research Division of the Department of Scientific and Industrial Research. Co-ordination of the work is to be effected by the Department of Scientific and Industrial Research.

Such are the recommendations on research made by the Commission, and they have no doubt been carefully considered. It is plain that they place the Department of Scientific and Industrial Research in a highly responsible position at the centre of a highly elaborated organisation for dealing with a subject, that of research, which from its very nature is particularly difficult to organise. The maintaining together of sufficient elasticity in administration, insight and efficiency in the various directing bodies and their staffs, and goodwill in all concerned, will call for a very exceptional power of co-ordinating these estimable but not all-pervading qualities. The research programme is, however, so comprehensive as to give large scope for choice and initiative in its translation into active research, and even a fractional fulfilment of its promise would be a great national benefit. One note of warning may be sounded. If those engaged in the coal industry begin to make the assumption that research and pioneering work are essentially the concern of the nation or some association, and no longer that of the firm or the individual, many of the paths of progress, and quite probably the best, will be left unexplored.

JOHN W. COBB.