

for which a central laboratory is the proper home, a laboratory fitted and equipped in an ample manner, with a trained and competent staff animated, like those, my colleagues, who have built up the National Physical Laboratory, with a love for science, and yet withal with a keen appreciation of the practical side of the question discussed and a real desire to help our country by the application of science to industry.

The body controlling industrial science research must have access to a laboratory in which may be studied the many problems which do not require for their elucidation appliances of the more specialised "works" character, or opportunities only to be found in particular localities; where a staff is available, able and experienced, ready to attack under the advice of men skilled in industry the technical difficulties met in applying new discoveries on a manufacturing scale or to develop ideas which promise future success.

Such a rôle the National Physical Laboratory should be prepared to play; such is the future which I trust may be in store for it.

#### COAL AND FUEL ECONOMY.

IT may be hoped that nowadays no one needs to be reminded about the importance of the economical use of coal. We require all, and more than all, of the power and by-products which can be obtained from it, and are beginning to realise the value of the thousands of tons poured annually into our atmosphere with none but deleterious effects.

A committee of no fewer than forty-six members appointed by the British Association at the 1915 meeting, and containing representatives qualified to speak on the various aspects of the problem, presented its first report at the Newcastle meeting last September, when it was the subject of a joint discussion between the Chemical and the Engineering Sections.

At the same meeting there was also a discussion by the geologists and the chemists on the chemical and microscopical characters of different varieties of coal with a view to their more effective utilisation as fuel and to the extraction of by-products. The two discussions, though at the meeting quite distinct, may well be considered together, since they deal with different aspects of the same question. It is not proposed here to deal with the many papers seriatim, but rather to review the general lines of the discussion.

When chemists, geologists, and engineers meet to consider the coal question, three different views are ever present. The chemist regards coal as the valuable source of raw material for the manufacture of synthetic drugs, dyes, and certain high explosives and ammonium sulphate, and would have us carbonise all our coal in by-product recovery plants so as to waste none of these precious substances. Though these substances represent only a small percentage by weight of the coal, their value to chemical industry is such that he cannot sit idly by and see them burnt away, particularly as the consumption of the resulting coke would help to diminish the smoke nuisance. The geologist looks upon coal as a rock of varying physical properties and chemical composition, and, feeling that his duty is to find coal by mapping outcrops or stratigraphical evidence, regrets, in his endeavours to extend our coalfields, that the chemist does not come to his assistance in assigning a particular value to the coal in each seam. The chemist investigates a sample of coal for some specific purpose, benzol or ammonia content, for example, but the geologist would like him to come forward with a definite classification, saying which coals were best for steam or domestic

purposes, etc. He feels that both ultimate and ordinary commercial analyses should be carried out, and that the chemist should know the nature of the roof and floor of the seam from which his sample was taken. The palæobotanist might be of great value in association with chemistry, for, as it is known that coal consists of an assemblage of the remains of very many kinds of plants, if it could be shown that particular by-products resulted from particular plants or parts thereof, palæobotanical investigation would show the commercial value of coal from any one seam.

There are, however, certain difficulties. Though much has been discovered by the action of solvents, chlorine, etc., on coal as regards the cellulose and resinic constituents, so many secondary changes may have taken place in the history of a seam that to associate them with individual plants or parts of plants may not be justified, for the decomposition of the original vegetable constituents might prove to be more important than the constituents themselves.

The engineer would have us turn our coal into cheap power, preferably electrical, on account of the ease of distribution. Just as there are trunk lines of railway, so there should be trunk lines of electric power generated from the largest and most economical machines in stations situated in the best localities for the needs of any district where land is cheap and coal and water plentiful. But just as the branches from a trunk railway enable the towns at their termini to develop in a way impossible without the trunk line, so trunk power mains would enable collieries to use their friable coal unfit for transport by turning it into electrical energy, at the same time extracting the by-products, for they would have a means for distributing their power which at present they do not possess.

It would really seem that for industrial purposes this is the line for advance, having in view economy, and the North-East Coast power system may be taken as an example in this country of the theory put into successful practice. It goes a long way to satisfy the chemist in his reasonable desire for by-products, and the efficiency of the conversion of coal into electricity is great if properly developed.

Economy in the domestic consumption of coal is more difficult. Gas is acceptable for cooking purposes, but the Englishman has a strong preference for warming himself by the direct radiation from a fire instead of the far more economical stoves so common in other countries. People must be educated in this matter, and no doubt the Domestic Fuel Sub-Committee of the General Committee mentioned at the commencement of these remarks will see to it that this is attempted. Manufacturers realise that smoke pouring from their chimneys implies bad stoking, and this means waste, and is consequently avoided so far as possible, but smoke from a domestic chimney conjures up visions of the crackling fire and genial warmth within the house.

The two discussions at Newcastle, if not producing any very new points, helped greatly in showing how we stand in relation to this most important question, and it is to be hoped that the committee will be in a position to present much valuable information in their next report. A *rapprochement* between chemists and engineers seems to be coming about, but the chemist and the geologist look as though they would continue grubbing for some time yet in a coal-seam on individual purposes intent. The satisfactory solution of the problem will require all three to work hand in hand, and now is the time, when co-operation is on everyone's lips, to achieve this happy result in the interest of the nation.